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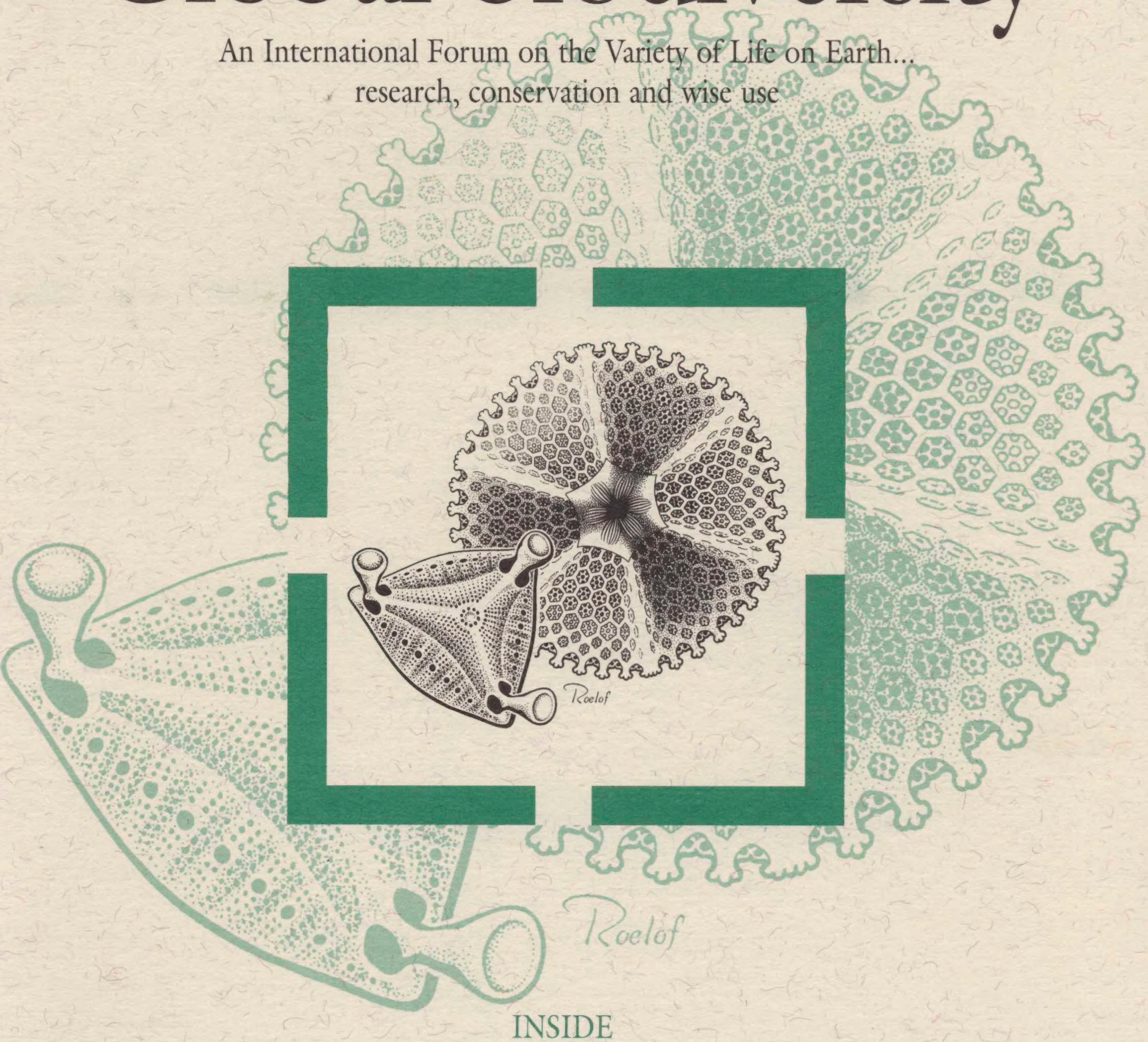
■ CANADIAN MUSEUM OF NATURE ■

Global biodiversity

An International Forum on the Variety of Life on Earth...
research, conservation and wise use



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marine biodiversity than Micronesia?

■

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Freezing biodiversity – right or wrong?

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Editor's Notebook

SHARING BENEFITS FROM BIODIVERSITY

One of the many goals of the Convention on Biological Diversity is to share the benefits of biodiversity between North and South; previously, benefits accrued largely to the North. This sharing would make the world economic system more equitable and just. It would also act as an incentive for the South to save its wealth of diversity.

But for the benefits of biodiversity to be shared, mechanisms need to be put into place at corporate levels, both nationally and internationally. The mechanisms must deal with how benefits are shared and what to do when individuals, corporations, or nations evade their responsibilities and obligations. The article on marine biodiversity on page 2 discusses one instance where suitable mechanisms for equitable sharing are lacking.

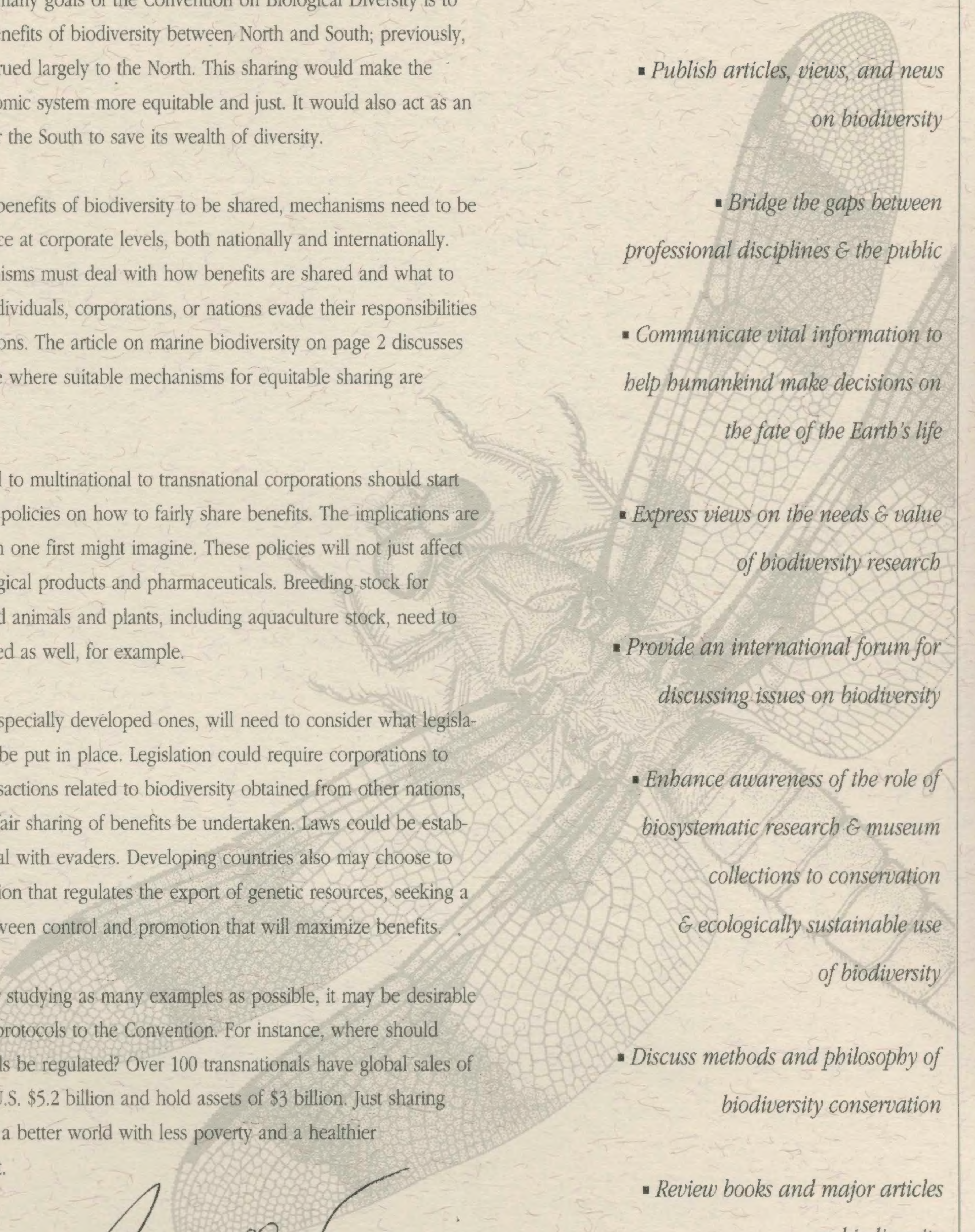
International to multinational to transnational corporations should start establishing policies on how to fairly share benefits. The implications are broader than one first might imagine. These policies will not just affect biotechnological products and pharmaceuticals. Breeding stock for domesticated animals and plants, including aquaculture stock, need to be considered as well, for example.

Countries, especially developed ones, will need to consider what legislation should be put in place. Legislation could require corporations to register transactions related to biodiversity obtained from other nations, and then a fair sharing of benefits be undertaken. Laws could be established to deal with evaders. Developing countries also may choose to pass legislation that regulates the export of genetic resources, seeking a balance between control and promotion that will maximize benefits.

Finally, after studying as many examples as possible, it may be desirable to develop protocols to the Convention. For instance, where should transnationals be regulated? Over 100 transnationals have global sales of more than U.S. $5.2 billion and hold assets of $3 billion. Just sharing could make a better world with less poverty and a healthier environment.

Don E. McAllister

Don E. McAllister
Editor



The goals of Global biodiversity are to:

- *Publish articles, views, and news on biodiversity*
- *Bridge the gaps between professional disciplines & the public*
- *Communicate vital information to help humankind make decisions on the fate of the Earth's life*
- *Express views on the needs & value of biodiversity research*
- *Provide an international forum for discussing issues on biodiversity*
- *Enhance awareness of the role of biosystematic research & museum collections to conservation & ecologically sustainable use of biodiversity*
- *Discuss methods and philosophy of biodiversity conservation*
- *Review books and major articles on biodiversity*

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Global biodiversity

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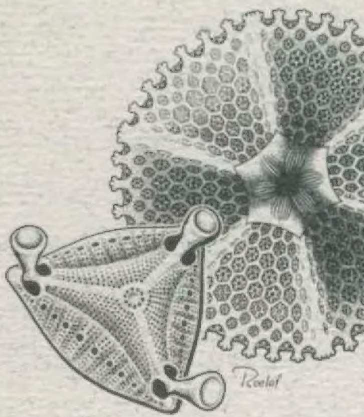

The cover art shows two species of diatoms in the Centrales group, which have radial patterns of wall decoration and are circular, triangular, or star-shaped. For more on diatoms, see page 11.

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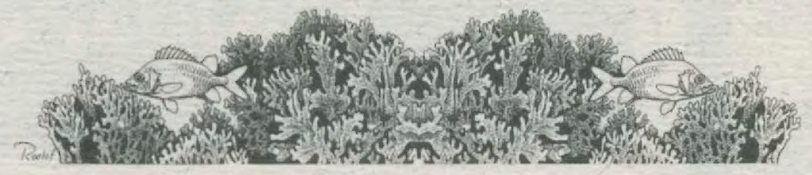

Marine biodiversity: Who benefits, who pays?

The higher taxonomic groups like families, orders, classes, and phyla are more genetically distinct than genera and species . These groups can also be expected to be more biochemically diverse. The ocean is richer in higher taxonomic groups than the land, and are bound to be rich in diverse compounds and genes that will be useful to the biotechnological and pharmaceutical industries. An important question then arises: How does the South, rich in marine biodiversity, secure its share of benefits from its natural heritage? [D.E.M.]

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THE HEART OF THE ISSUE

As a sport diver and conservationist I have been taught to scuba dive in an eco-friendly manner by "taking nothing but photos." Therefore, when investigating environmental issues for the East-West Center, I had mixed feelings as I watched a group of Japanese scientists off the Pacific island of Yap hack off a large, flowing, purple, tree-like *Dendronephthya* soft coral.

I abhor needless destruction, but felt that this particular invertebrate had died for what might be a good cause. The hackers were researchers with the Marine Biotechnology Institute (MBI), based in Japan, and the soft coral might someday provide a treatment for cancer. Exciting? Certainly. But also disturbing. Japan is paying nothing to the Federated States of Micronesia (FSM) for research rights. Thereby, this situation gives life to a key issue flagged at the Earth Summit in Rio:

Who benefits from tropical biological diversity and who should pay to conserve it?

INTRODUCING MBI—THE DEVELOPER

Japan leads the world in marine biotechnology. Partly, its leadership is due to vision and an explorative spirit. Largely, however, Japan's strong position is due to its ability to combine governmental and private interests. MBI receives half its funding from MITI, the Japanese Ministry of International Trade and Industry, and half from a consortium of 24 leading corporations, including blue chips such as Suntory, Nippon Steel, Hitachi Zosen, Shiseido, and Kyowa Hakko Kogyo pharmaceutical company. It is difficult to imagine a similar union in the United States, where companies traditionally go it alone. One prominent American researcher predicts that, due to imaginative approaches such as MBI's, "Japan will wipe the United States off the map" in the field of biotechnological research.

MBI's union of public and private interests has resulted in an organization capitalized at 800 million yen with 80 employees and two research laboratories, one in Kamaishi on the "cold water" side of Japan and one in Shimizu on the "warm water" side. It also owns the 95 metre long research vessel *Sohgen Maru.*

MBI is playing for home runs. MBI noted in a letter to the Federated States of Micronesia, of which Yap is one of four states, that it was looking for new anti bio-fouling agents to replace toxic barnacle-resistant paints, bacteria that "eat" spilled oil, and phytoplankton that fix large quantities of atmospheric carbon dioxide (CO_2). Many of the MBI scientists added that they had another very real, but unwritten, objective—pharmacologically active compounds. All these categories offer potentially large returns to those who develop them first. Thomas Veach Long II, Chairman and President of Maricultura, an American biotechnology company engaged in marine research, says that any of these categories could ultimately be worth $5 billion a year.

ERRATUM

The Managing Editor apologizes to Mr. Sochaczewski for incorrectly captioning the photo that accompanied his article "Can a new Melastome save "the prettiest island in the Pacific?" in *Global biodiversity* 4 (4). The people in the photo are Eric Waguk and Jim Juvik.

DEVELOPING PHARMACEUTICALS

After a day spent in Yap's natural steambath, it is a shock to enter the *Sobgen Maru*'s air-conditioned lab. I watch scientists place a nasty-looking black sea cucumber in an aquarium. Sample Y-29, a rust-coloured sponge that looks like curried tripe, is photographed, weighed, and pickled as are 12 other samples gathered that day. Researchers called this a poor-to-average day's collection.

What might be the commercial value of these modest-appearing sea creatures? Let's look first at pharmaceuticals. Much publicity has been given to the pharmacological potential of terrestrial plants, but little attention has been paid to the complex, and relatively unexplored, marine ecosystem. William Fenical, an organic chemist at the Scripps Institution of Oceanography in San Diego, California notes that "Nature is so creative and exceptionally prolific that we haven't been able to compete in creating substances active as drugs." D. John Faulkner, also with the Scripps Institute, estimates that perhaps 50% of the next generation of pharmaceuticals will come from marine biotechnology research. Faulkner offers these examples of pharmaceutical chemicals which are currently being studied:

- **Discodermolide**, from the Bahamanian sponge *Disscodermia dissoluta*, is a powerful immuno-suppressive agent that may have a future role in suppressing organ rejection after transplant surgery.
- **Bryostatin**, from the US West Coast bryozoan (moss animal) *Bugula neritina*, and **Didemnin B**, from a Caribbean tunicate of the genus *Trididemnun*, are both in clinical trials as cancer treatments.

But interesting lab results do not necessarily lead to commercially-viable products. The common, dark-grey sponge *Luffariella variabilis*, for instance, produces large amounts of **manoalide**, a chemical that has anti-inflammatory and pain-killing effects. Laboratory results were so encouraging that Allergan Pharmaceuticals began a development program to see whether a commercial drug could be brought to market. Faulkner notes that research on manoalide has lasted for 10 years, and the development of a drug based on this chemical will take several more.

So it is not only a lengthy voyage between identifying an interesting compound and starting to make money, but an expensive one. The U.S. Pharmaceutical Manufacturers Association estimates that it costs $230 million to get a new pharmaceutical product to market. In addition, the likelihood of discovering a valuable pharmaceutical compound is low. Walter Reid, Vice President of World Resources Institute, cites studies that indicate that fewer than 10 out of every 10,000 to 35,000 randomly selected and screened chemical samples will reach clinical trials. Less than one in ten drugs reaching clinical trials will gain final approval as a new drug. This highlights the long lead time, significant financial investment, and substantial uncertainty required before a company can bring a new drug to market, facts which must be recognized by developing countries eager to cash in on the "potential" value of their natural resources.

Researcher aboard the *Sohgen Maru* with samples. (Photo by Paul Sochaczewski)

Nevertheless, such research continues apace. Marcus Tius, a biochemist at the University of Hawaii, has funding from Mistsubishi Kasei, a Japanese pharmaceutical company, to research a cancer preventative compound found in a widespread Pacific soft coral. The compound has proved effective when tested on mice, and toxicity tests on mice are now underway. Tius warns, however, that no one has ever tried to develop a chemical that *prevents* cancer, and there is no established protocol for testing such a substance. He also warns that his team is working on a 10-12 year time frame and that they are a long way from having an effective and safe drug on the market.

RESEARCHING OIL-RELATED BACTERIA

Environmentalists have high hopes for oil-eating bacteria that assist in a process called bioremediation, a relatively nonintrusive method to biodegrade oil by-products in environmentally sensitive areas. Tom Merski, regulatory analyst of the National Environmental Technology Application Corporation, notes that there is an average of 13,000-14,000 oil spills in the United States alone each year, and physical remediation cleans up only 20% to 40% of the oil. Charles Johnson, Research Associate at the East-West Center and an expert in the petroleum industry, estimates that a practical bacteria-based oil clean-up process could conceivably save 50% of the present clean-up costs. Such natural methods have been tested in the *Exxon Valdez* spill and the spill resulting from Iraq's destruction of Kuwaiti oil fields during the Gulf War, and the results are promising.

Johnson adds that similar chemical investigations could lead to bacteria that "haemorrhage" underground oil, thereby potentially solving an extraction problem. Presently two-thirds of of the world's oil deposits cling to sediment and is, therefore, difficult to extract.

USING BIO-AGENTS IN THE SHIPPING INDUSTRY

The shipping industry uses anti-fouling agents to keep hulls clean of barnacles and other nuisances. If hulls are not clean, the ships may burn 20% to 40% more fuel and be forced to spend more time in dry dock for cleaning. The problem, however, is that most anti-fouling agents are highly toxic. Conceivably, a natural anti-fouling agent could help shipping companies and navies reduce running costs without damaging the environment.

EXPLORING ORGANISMS THAT ABSORB CO$_2$

Aboard the *Sohgen Maru* I watch scientists place bits of dead coral in glass bottles. Wataru Miki, the research director of the MBI expedition, explains that the upper surface of coral rubble and various seagrasses provides a home to organisms that fix large quantities of CO$_2$. Miki-san explained that most micro-algae die at CO$_2$ concentrations above 0.5%; MBI is looking for micro-algae that will survive 20% CO$_2$ concentrations. MBI has already isolated *Prochloron* cells from the reefs of the U.S. Trust Territory of Palau that exhibit significant CO$_2$-fixing properties. Possible industrial applications? Filtering CO$_2$-laden factory emissions through specially constructed algae-rich lagoons, which will help to reduce the greenhouse effect and provide healthier air.

Dendronephthya
soft coral

INTRODUCING FSM, THE RESOURCE

This is exciting science—the possibility of new drugs to treat cancer, bacteria that gobble up oil spills, eco-friendly methods of preventing barnacle build-up, and plankton that convert CO$_2$ into compost. So, what's wrong? The fact that bothers me is that FSM is selling itself cheap.

While there is chemical magic in the seas, MBI has used some terrestrial sleight of hand in negotiating rights to explore for new chemical compounds. One telling moment came while MBI hosted a reception for Yapese officials aboard the *Sohgen Maru*. The Japanese researchers offered crab claws, smoked salmon, and beer, whisky, and sake to their guests, some of whom were tribal leaders from the outer islands. The presence of the out-islander leaders, wearing simple royal blue *thuw* loincloths, underlined the fact that in Yap *all* land and water is privately owned. Although MBI negotiated rights with the FSM government, they also had to get permission from clan leaders to dive on the reefs. Interestingly, unlike most nations where reefs are public marine resources, Yap's constitution not only recognizes private and communal ownership of the reefs, it also authorizes the Yap Council of Pilung (comprised of traditional clan leaders) to ensure that "no foreign fishing, research, or exploration vessel will take natural resources from any area within the state's marine space, except as may be permitted...."

The high point of the reception came when Dr. Mamoru Endo, senior manager in MBI's Research Planning Division, entertained the group with remarkably good magic tricks. He moved rings through each other, played mind-eye games with coloured scarves, and tied and untied knots in rope without touching the props. At one point he asked for a volunteer, and got an Australian woman who mischievously insisted on tightening the knots even more. Endo-san, mock pleading in his voice, said, "I need a *kind* volunteer." MBI couldn't have found a kinder volunteer that FSM, considering the market potential of the chemicals that might be developed from MBI's research!

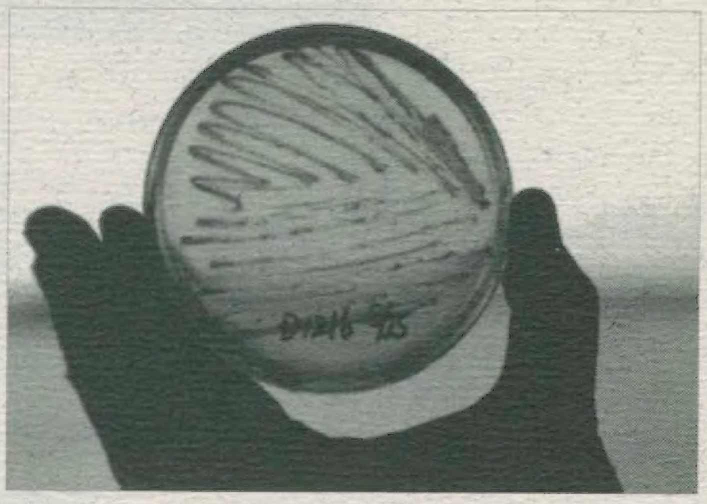
In exchange for permission to collect in FSM territorial waters, MBI will provide the host government with a copy of their research, a sea water analysis, and some training. No exploration fee, no share of potential royalties. There is, of course, a poor-rich irony here. FSM and neighbouring Palau, where MBI also collects samples, are among the world's poorer countries in economic terms, but among the richest in terms of biological diversity, particularly marine diversity. FSM's reefs, for example, have 60% of the world's coral species, while Palau (and northern Australia, Indonesia and the Philippines) boast 70% of all coral species, the highest in the world. By contrast, the Caribbean has approximately 20%. One of the key debates at Rio focused on the responsibility of the "gene-rich" countries, such as FSM and the other poorer countries of the South, to protect their biodiversity for the benefit of the world at large. The tropical countries then pointed out that if these resources were so important to the North, then the North should help pay for their conservation—*and* pay again if somebody in the North made money by exploiting that diversity.

Here we have a situation where FSM and Palau have outstanding diversity but poorly-developed conservation and marine resource programs. In the true Pacific spirit of sharing, however, FSM and Palau have generously welcomed MBI to take as much as it wants, and thanks for the visit.

Why didn't FSM ask for more? They might have structured a three-part deal, similar in parts to an oil exploration concession. First, they could have asked MBI to pay a basic exploration fee that would have given MBI exclusive exploratory rights for, say, ten years. Then, if MBI were to develop commercially important chemicals, they would have paid FSM a royalty. Lastly, FSM might have asked the Japanese to help it in developing an appropriate and sustainable marine-based commercial activity, such as seaweed cultivation and high-value tuna fishing to feed Japan's sashimi-hunger.

Why didn't FSM ask for these things? Perhaps, FSM leaders were afraid that by raising the stakes the Japanese would have gone elsewhere. But FSM is in a stronger position than it might realize—the country is close to Japan and stable. From a cynical view, the Japanese may have actually preferred negotiating with FSM officials than with canny bureaucrats from Indonesia or the Philippines.

The FSM delegation might have productively stopped off in Costa Rica on the way back from Rio in 1992. The small Central American country, which has become the darling of the environmental movement, has entered into a "chemical prospecting" agreement with Merck & Company of Rahway, New Jersey. Says Rodrigo Gamez, a plant virologist who runs INBio, Costa Rica's National Biodiversity Institute: "We want to put our biodiversity to work for us. But we want to be perceived as partners, not as a resource to be exploited." In the first of what Gamez hopes will be several partnerships with drug companies, Merck is providing $1 million over two years; in return it will acquire exclusive rights to screen for pharmaceuticals from plants collected by INBio. Any profit must be shared with Costa Rica.


Culturing the day's catch aboard the *Sohgen Maru* (Photo by Paul Sochaczewski)

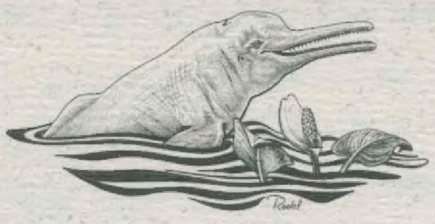
Not everyone in the research community agrees with this approach. D. John Faulkner notes that in return for collecting marine organisms of possible pharmacological use from Pohnpei, another state of FSM, the Scripps Institute gives lectures, on-site training, and copies of the research reports to their Pohnpeian hosts, but no money. "It's short-sighted [for a country] to ask for money up front," he argues. "Research will come to a halt if all countries demand a million dollars for exploration rights."

Could a Costa Rican model work for FSM? Perhaps, but not without effort and good will on both sides. Primarily it involves facing up to basic issues:

- Some considerations are legal: Who "owns" the biodiversity?
- Other issues are economic and (relatively) straightforward: Who stands to benefit from the biodiversity? Who pays to develop it?
- The trickiest questions are ethical: Whose responsibility is it to protect nature's wealth?

When FSM president Bailey Olter spoke at the Rio Earth Summit, he observed that "the Pacific Region is one of the world's troves of biological diversity [which is of] fundamental importance to the people of the Pacific." Unfortunately, his ambassador in Tokyo, who negotiated the deal with MBI, apparently didn't get the message that FSM has a resource of real value—its marine diversity. The sooner FSM realizes it, the better for biodiversity conservation worldwide.

Paul Spencer Sochaczewski (who recently changed his name from Paul Spencer Wachtel) is head of creative development at WWF-World Wide Fund for Nature International in Switzerland, and a professional associate working with MacArthur Foundation that funds the East-West Center in Hawaii. He is currently writing a book that updates the Asian explorations of naturalist Alfred Russel Wallace.



UNEP's contributions to biodiversity management

The United Nations Environment Programme (UNEP) has a long record in conservation of biodiversity and sustainable use of biological resources. These efforts have been crowned with the recent first conference of the Parties to the Convention on Biological Diversity in Nassau in November 1994. The Convention provided a major opportunity for humankind to undertake the revolutionary steps needed to live in harmony with the planet's species and ecosystems. [D.E.M.]

UNEP
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Nairobi,
Kenya

At the 1992 United Nations Conference on Environment and Development (UNCED), the world witnessed the birth of the Convention on Biological Diversity. This binding legal document was negotiated by governments under the leadership of UNEP with the advice of experts in fields as diverse as science, economics, and law.

Considering the Programme's 22 years of experience in conserving the Earth's biologically diverse resources on three levels—ecosystems, species, and genetic resources, UNEP's role in the negotiation was natural. UNEP's conservation endeavours are extensive. It supports individual countries in establishing and maintaining protected areas, but also works on a global level with intergovernmental organizations and non-governmental organizations (NGOs). Among other things, it fulfills the legal role of Secretariat to many biodiversity-related Conventions. such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on the Conservation of Migratory Species of Wild Animals (CMS).

UNEP is committed to halting the destruction of biodiversity and promoting the sustainable use of natural resources. This commitment is evident in its work in environmental assessment and management, which includes support measures such as law, education, training, information and technical assistance, as well as hosting the Interim Secretariat of the Convention on Biological Diversity.

ECOSYSTEMS

From its inception, UNEP has recognized the importance of ecosystems in conservation by supporting research activities and helping governments create and maintain protected areas worldwide. These ecosystems—from tropical forests to the high seas—display divergent characteristics, to say the least.

Biodiversity and Microclimate of the Tropical Forest Canopy, a showcase project for UNEP in the field of biodiversity is currently underway in Panama in collaboration with the Smithsonian Tropical Research Institute (STRI). This field-oriented project, which enjoys the support of many scientific organizations and governments, is monitoring and researching the biodiversity of the forest canopy and investigating the interaction between the canopy and atmospheric changes. According to scientific estimates, 40% or more of the world's plant and animal species live in the uppermost canopy of tropical forests.

UNEP's **Clearing House** has played a substantial role in realizing this project. Established in 1982, The Clearing House solicits financial and technical support for projects in developing countries from donors throughout the world. With the aid of UNEP, the canopy project has attracted tremendous support. On the financial side, project donors have contributed $285,258. On the technical side, scientists from 14 countries are working on 25 inter-linked projects. In November 1994, UNEP and STRI published "Accessing the Canopy," a comprehensive report of the project's findings.

UNEP also helps to protect the biodiversity of marine ecosystems, such as mangroves and coral reefs, via its *Regional Seas Programme.* Initiated in 1974 and coordinated by UNEP's **Oceans and Coastal Areas Programme Activity Centre** (OCA/PAC), the Programme includes 13 regions at various stages of development and more than 140 participating States and Territories. UNEP has coordinated meetings, research, and other activities to support the work of governments following the adoption of 10 regional action plans. Currently, the Programme is helping to develop five new marine environment action plans. It will also support the new *International Coral Reef Initiative.*

OCA/PAC tailors each regional programme toward alleviating the problems that individual governments identify, but does so in line with the objectives it perceives as vital to improving their regional marine environments. The Regional Seas Programme then assists governments in the implementation phase of the action plan, through the creation of financial management schemes. One popular scheme is to create a trust fund to which donor governments can contribute.

Environmental management, a crucial component of each plan, is imperative to biodiversity conservation. UNEP supports such management by providing participating governments and organizations with training and information in environmental impact assessment and integrated management of coastal areas, including lagoons, estuaries and mangrove ecosystems. OCA/PAC has also helped most of the regions assess the effects of pollution, including land-based sources, on the balance of marine ecosystems biodiversity.

SPECIES

UNEP also focuses conservation efforts on specific life forms that play special roles in the balance of an ecosystem. Their presence can testify to a healthy ecosystem. Examples include the elephant, the rhinoceros, and the tiger. In this light, efforts to support these animal populations also aim at conserving biodiversity, and UNEP's contributions include the establishment of a UNEP *Elephant and Rhinoceros Conservation Facility* in Africa and Asia and a *Global Tiger Forum* in Asia.

Another UNEP effort, the *Global Plan of Action for the Conservation, Management and Utilization of Marine Mammals* (MMAP) is helping governments implement policies to conserve and manage marine mammals worldwide, including threatened species such as the Mediterranean monk seal, the West Indian manatee, and the river dolphin.

GENETIC RESOURCES

Although *in-situ* conservation in the form of ecosystem and species conservation is UNEP's most visible work in biodiversity conservation, UNEP understands that conserving biodiversity and harnessing it for sustainable development also relies on *ex-situ* conservation. UNEP participates in this field through its work in genetic resources and promoting the use of microorganisms.

UNEP has financially supported conservation of crop and tree genetic resources and endangered livestock genetic resources. In addition, it provides funding for training programmes in genetic resource conservation for participants from the developing world. It contributes to the international programme for conservation of crop and tree genetic resources implemented by the International Board for Plant Genetic Resources (IBPGR) thus helping the global network of genebanks in more than 30 countries. By 1991 these banks had collected more than 200,000 plant samples. UNEP's support of a pilot project to conserve endangered livestock genetic resources, executed by the UN Food and Agriculture Organization (FAO), has resulted in pilot genebanks and databanks in Africa, Asia, and Latin America.

In 1974 and 1975, UNEP formulated the concept of applying environmental microbiology at **Microbiological Resources Centres** (MIRCENs) in developing countries and drew up an action plan to establish a

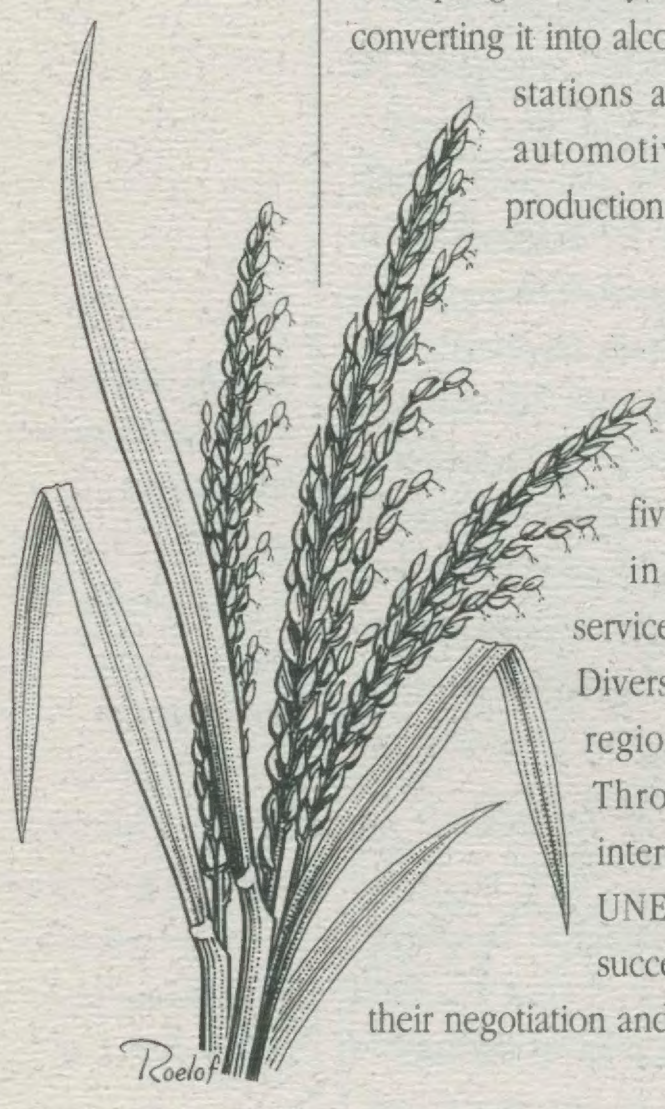
From its inception, UNEP has recognized the importance of ecosystems—from tropical forests to the high seas—in conservation. It supports research activities in this area and helps governments create and maintain protected areas worldwide.

world network of such centres. Today there are regional MIRCENs in Bangkok, Beijing, Cairo, Dakar, Damascus, Guatemala City, Nairobi, and Porto Alegre, Brazil. UNEP also helped establish a **World Data Centre of Microorganisms** (WDC) and the **Microbial Strain Data Network** (MSDN), which manage information on microbial genetic resources and provide information and training to the MIRCENs. Each centre is the focal point of a regional network of collaborating institutions that carry out various related projects.

In nature, microorganisms play an important role in the production of food, animal feed, medicine, and chemicals. They also provide nutrients for other life forms. In MIRCENs scientists are discovering new roles for microorganisms as alternatives to chemical fertilizers and in recycling waste to produce energy. Farmers who can afford chemical fertilizers use them, but they have a steep price. Although these fertilizers contain high levels of nitrogen, which increases soil fertility and food production, they are expensive, pollute soil and ground water, and possibly harm the ozone layer.

UNEP understands that conserving biodiversity and harnessing it for sustainable development relies, in part, on *ex-situ* conservation, such as the conservation of crop, tree, and endangered livestock genetic resources.

Some MIRCENs are proving that biological nitrogen fixation (BNF) is an alternative to such environmentally hazardous fertilizers. UNEP is assisting these centres in projects encouraging local farmers to use BNF. The results are better soil fertility and higher crop yields. A project directed by the Bangkok MIRCEN recycles waste produced from processing cassava (a fleshy rootstock of the spurge family, genus *Manihot*) by biologically converting it into alcohol fuel. Three governmental petrol stations are now using this alcohol as an automotive gasoline substitute for the production of benzohol.



LEGAL

In the international legal forum, UNEP serves as the secretariat to five global environmental conventions in addition to providing interim services to the Convention on Biological Diversity. It is also the secretariat to 13 regional instruments or organizations. Through its involvement with these international and regional agreements, UNEP has proven its ability to successfully and cost-effectively support their negotiation and implementation.

Two of the conventions directly relate to biodiversity conservation issues. CITES, one of the best-known Conventions, which entered into force in 1975, aims to protect endangered and threatened plant and animal species populations from harmful effects of commercial exploitation. The CMS helps protect species that migrate over many national boundaries.

Of the 13 regional instruments that profit from UNEP's secretariat services, 7 focus on environmental problems caused by pollution, while 6 directly concern the conservation of biodiversity through encouraging the creation of specially protected areas, the conservation of wild fauna and flora as well as protection of marine and coastal environments in places as varied as the Mediterranean, West and Central Africa, the wider Caribbean, and Eastern Africa.

DEVELOPING THE IDEAS BEHIND BIODIVERSITY

UNEP has also had a hand in drafting documents that aren't legally binding, but nonetheless, profoundly affected the Convention's contents and its evolution. In 1980, 12 years before the Convention's adoption in Rio, UNEP produced the most influential conservation document of the decade, which later paved the way for the Convention. *The World Conservation Strategy*—launched with the World Conservation Union (IUCN) and the World Wide Fund for Nature (WWF)—formally established the link between living resource conservation and sustainable development. It cited three major objectives: maintaining essential ecological processes and life-support systems; preserving genetic diversity; and ensuring sustainable utilization of species and ecosystems. The Strategy brought the importance of genetic diversity to international attention and inspired more than 50 national-level conservation analyses and strategies. Eight years later, UNEP teamed up again with IUCN and WWF to establish the **World Conservation Monitoring Centre** (WCMC) to help achieve the Strategy's objectives. The WCMC, which gathers, analyses, and disseminates data on global biodiversity, has become vital in assessing the condition of biodiversity on which to build solid projects and policies, nationally and internationally.

The dawn of the 1990s saw UNEP at the forefront of biodiversity conservation again. It did more than make substantial contributions to the negotiation of the

Convention on Biological Diversity. In one year it presented, in collaboration with distinguished NGOs, three important documents: *Caring for the Earth: A Strategy for Sustainable Living*, the *Global Biodiversity Strategy*, and the *Global Biodiversity Status of the Earth's Living Resources*.

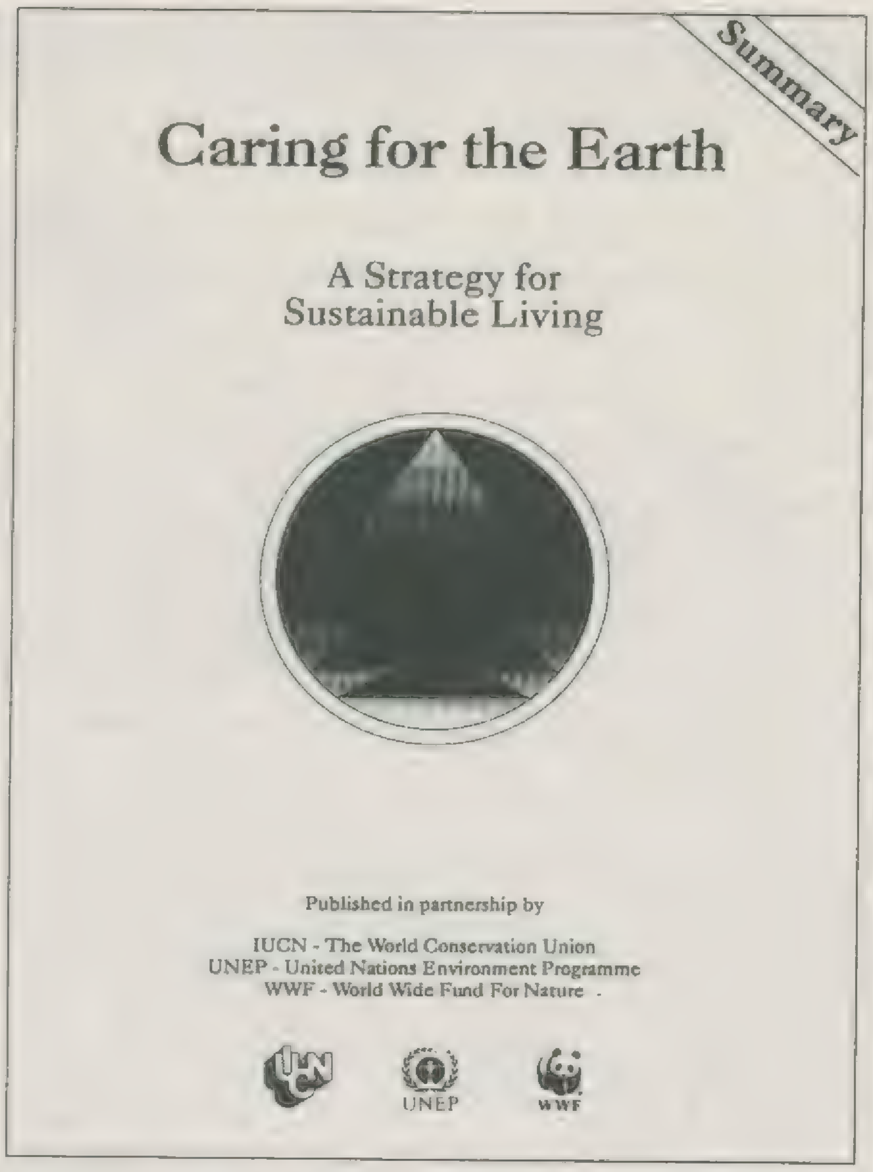
In the 1991 *Caring for the Earth*, UNEP, IUCN, and WWF responded to the challenges presented by a new decade of mounting environmental, social, and economic pressures. The document reinforced the importance of conserving biodiversity. It also explained how biodiversity is necessary for social and economic progress and sustainable development.

That same year, UNEP, IUCN, and the World Resources Institute (WRI) built on *Caring for the Earth* by collaborating with WWF and the World Bank to produce the *Global Biodiversity Strategy*. This strategy included recommendations on ways to implement the broad prescriptions of *Caring for the Earth* and advance action at the local, national, and international levels, citing guidelines for actions to save, study, and use the Earth's biotic wealth sustainably and equitably.

UNEP also took part in the 1992 publication by WCMC of the *Global Biodiversity Status of the Earth's Living Resources*, the first comprehensive overview of the use and management of global biological resources. This was done in collaboration with the Natural History Museum of London and in association with IUCN, WWF, and WRI. The WCMC presented a 130-page update report at the Bahamas Conference of the Biodiversity Convention's Parties in November 1994.

UNEP was also part of the 1989 birth of the **Global Environment Facility** (GEF), a funding mechanism administered with the United Nations Development Programme (UNDP) and the World Bank. The GEF provides grants for investment projects, technical assistance, and a limited amount of research to help developing countries fund activities to protect the environment and transfer environmentally innocuous technologies. The preservation of biological diversity is one of GEF's main goals, in addition to reducing global warming, protecting international waters, and preserving the ozone layer. Originally established as a three-year pilot project, the Facility was restructured in March 1994 with a $2 billion commitment of funding.

By providing the secretariat for the **Scientific and Technical Advisory Panel** (STAP), UNEP plays an influential role in GEF's administration. Established in 1991 by the Executive Director, STAP (a group of 15 senior scientists from around the world) produces criteria and priorities for project selection, operates a roster of scientific and technical experts for project reviews and appraisals, and reviews and comments on proposed GEF projects.



Summary

Caring for the Earth

A Strategy for
Sustainable Living

Published in partnership by

IUCN - The World Conservation Union
UNEP - United Nations Environment Programme
WWF - World Wide Fund For Nature

Caring for the Earth, published by UNEP, IUCN, and WWF in 1991, explains how biodiversity is necessary for social and economic progress and sustainable development.

UNEP'S BIODIVERSITY PROGRAMME & IMPLEMENTATION STRATEGY

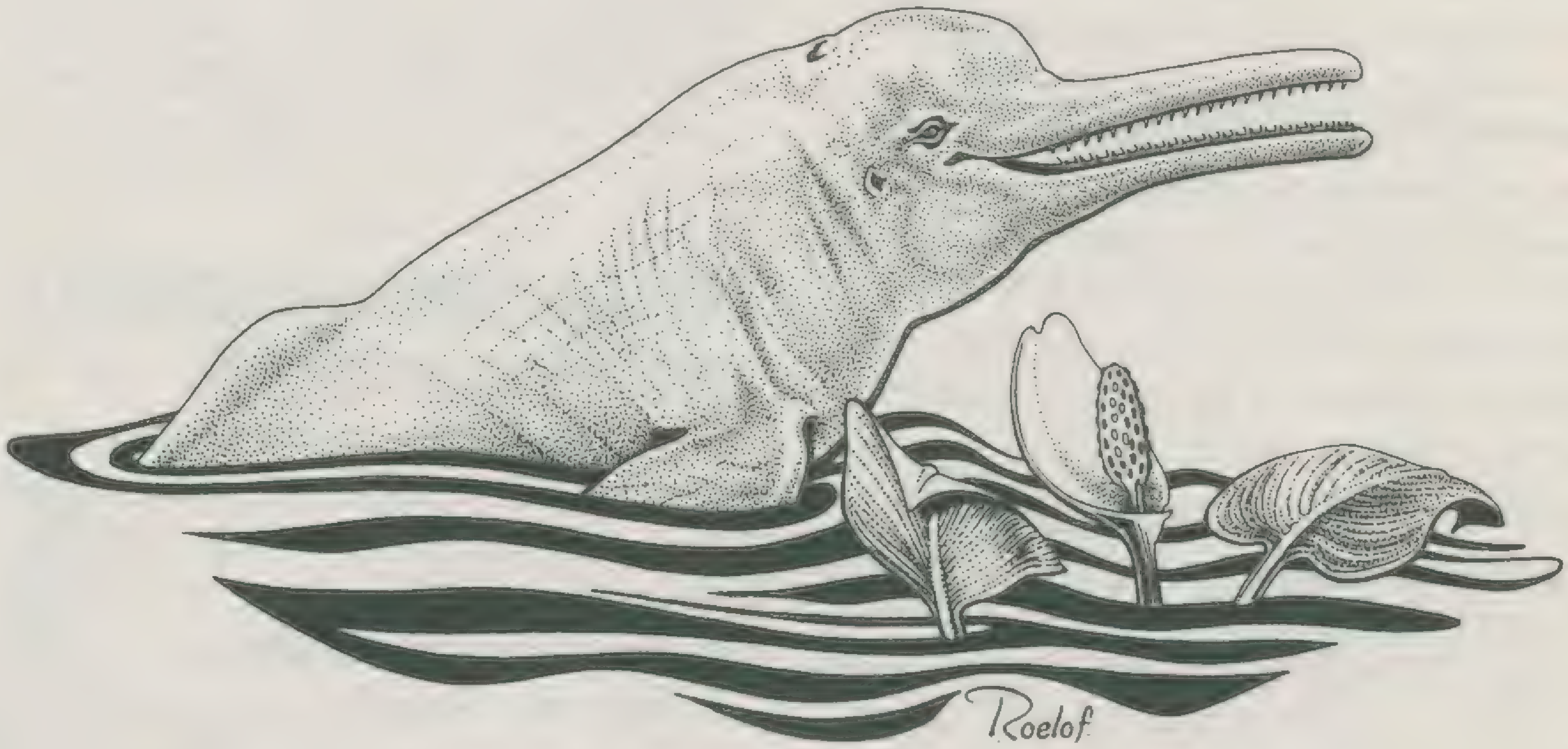
In light of all the developments in the conservation of biodiversity, UNEP has created the *Biodiversity Programme and Implementation Strategy* (BDPS) which supports the objectives in Agenda 21, the Convention on Biological Diversity, and other international agreements relating to the conservation and management of biodiversity. The BDPS is also an extension of the *Global Biodiversity Strategy* and *Caring for the Earth*. It will help formulate and implement biological diversity management in coordination with sustainable development efforts. In doing this, it takes into consideration all disciplines—economics, and the biological, chemical, and social sciences—to support the sustainable use of biodiversity in oceans, coastal areas, and freshwater and terrestrial ecosystems. It also calls for helping individual countries strengthen their abilities to assess, evaluate, and monitor biodiversity at the national level while encouraging community participation.

Substantial work on the BDPS has begun. UNEP has undertaken an immense responsibility by helping individual countries identify their biologically diverse resources, the legal mechanisms that protect them or could possibly strengthen conservation efforts, and the involved costs and benefits. Using these studies, countries will be able to create national biodiversity strategies and action plans that go beyond addressing environmental problems to include social and economic issues. By October 1994, UNEP had completed 12 country studies—in the Bahamas, Canada, Costa Rica, Germany, Guyana, Indonesia, Kenya, Nigeria, Peru, Poland, Thailand and Uganda—with 20 more ongoing.

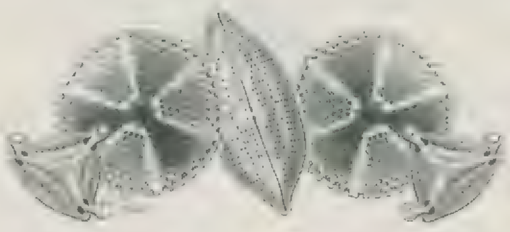
Another BDPS project is the publication of the *Global Biodiversity Assessment*, which has brought together approximately 1,000 scientists for the book's drafting and review process. The book will analyse available knowledge of the issues and examine theories and views concerning biodiversity from a scientific perspective. It will also have an accompanying publication—a summary for policy makers—that will interpret the book in layman's term so that people from politicians to community NGOs can understand it and use the ideas to promote the conservation and sustainable use of biodiversity. The projected publication date is August 1995.

The support, the guidelines, the assessments, and all other contributions UNEP has made to the conservation of biodiversity and to the Convention on Biological Diversity crosses traditional borders between countries and traditional lines that have separated the social and the physical sciences. It is an impressive track record, and UNEP rests assured that the dedication it has shown will continue long after the Bahamas Conference. In that light, UNEP has offered to serve as the permanent Secretariat for the Convention, should the Parties so decide.

UNEP has an impressive track record in working to conserve biodiversity in all its forms—from programs to protect species such as the River dolphin shown here to ecoystem projects to research in genetic resources. UNEP's contributions, assessments, guidelines, and support crosses both traditional borders between countries and traditional lines between the social and physical sciences.



Amazon River Dolphin *(Inia geoffrensis)*
This primitive member of the family Iniidae (locally known as the boutu, bufeo, or tonina) is widespread in the Amazon basin and has no predators other than humans. The boutu reaches 3 m and 100 kg. Their most striking feature is their colouration—ranging from light blue to pure white and most commonly, rosy pink. They are piscivores, swimming on their back just above the bottom while echolocating fish, which are seized by the large, toothed jaws. The boutu is a solitary animal, unlike almost all of the Cetacea.



Diatoms of the Canadian Arctic Sea Ice

Diatoms are tiny silicon-shelled plants that drift in the upper waters of the oceans and fresh waters. They help provide the oxygen we breathe and underpin the marine and freshwater food chains. Some diatoms even live in ice, as this article discusses; polar sea ice is a habitat that may be at risk from global warming. [D.E.M.]

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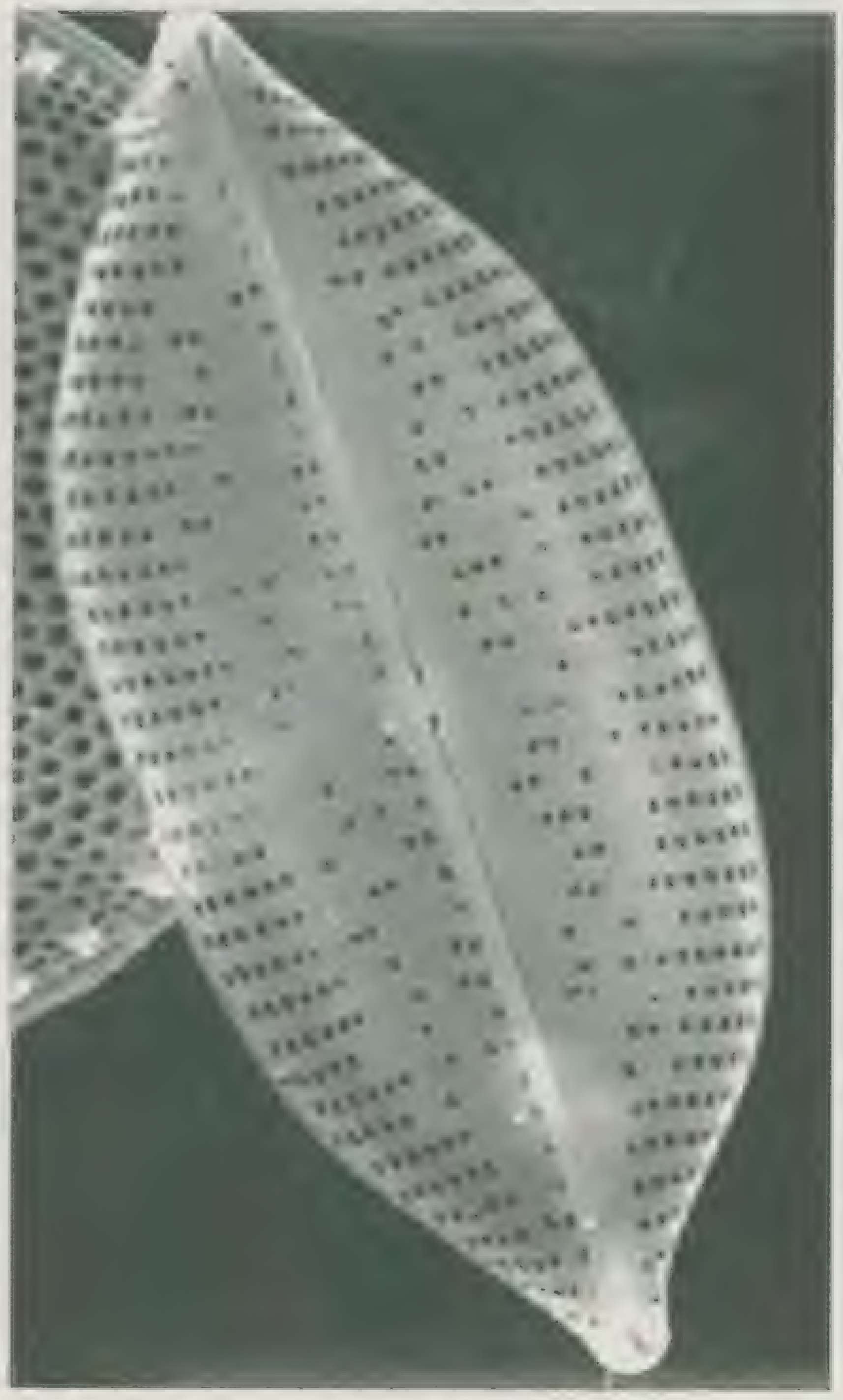
Diatoms are microscopic algae, single celled and chlorophyll bearing, enclosed in a silicon shell perforated in such a pattern as to permit the identification of the organism down to the species level. *Navicula trigonocephala* is a representative species of diatom assemblages found in the bottom layers of sea ice, of which almost 95% are made up of pennate diatoms, leaf-like, benthic (i.e. occurring at the bottom of a body of water), and fixed to the substratum. This species is characterized by its linear form, its pointed ends, its axis being more developed on one side of the raphe (the median slit of the diatom's valve) than the other, and its ribs being made up of fine areolae (pores) separated by smooth areas. The specimen in the photomicrograph measures 35 µm, or 0.035 mm.

These microalgae grow in the first 10 cm of the lower strata of ice. This is the growth area of ice where capillaries and pockets are plentiful. The process by which these benthic diatoms are incorporated in the ice in the autumn is still unknown, even though the re-suspension of sediments in coastal zones could be responsible. Whatever the process, these algae are not plentiful and stay dispersed in the sea ice throughout winter. As the spring sun melts the ice, the diatoms become concentrated in the lower levels of the ice where they can make use of appropriate light levels and the nutrients drawn from the underlying water. There then follows a period of intense reproduction that gives the lower ice strata a visible yellowish or brownish colour. With the continued warming by the sun, the ice breaks down and the algae become free-floating in the underlying water column. In the Arctic, this characteristic ice microflora can number up to a hundred species. Thus, diatoms play an important role in the production of this marine ecosystem, which has long been considered not very productive.



Photomicrograph of the diatom *Navicula trigonocephala*, endemic to the Arctic sea ice, taken with a scanning electron microscope. (Photo courtesy of Michel Poulin)

In memory of Gerald Durrell:

Naturalist, conservationist, author, and friend of animals

> *"The world is as delicate and complicated as a spider web. If you touch one thread you send shudders running through all the other threads.. We are not just touching the web, we are tearing holes in it."*

Suzanne Adamkowski
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Fiducie Pour la Conservation de la Faune au Canada
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It's fitting that the first word Gerald Durrell uttered was one that would determine the course of his life. When most babies were coming out with garbled variations on "mama" or "papa", the infant Durrell said—presumably to the astonishment of his mother—the word "zoo."

It soon became apparent that this was no random chance. At the age of two it was clear that the little boy's world revolved around that short word, the magical world where he could visit with the creatures he so adored.

His adoration was uniquely egalitarian. While most little kids love the big beautiful animals and the sweet babies, the young Gerry loved them all, the big and strong, the small and fragile, the beautiful, and some those with more clouded vision might consider ugly.

Born in India in 1925, his family returned to England following the death of his father in 1928. In those first three years in India, the local zoo offered a haven to a child of the city. But it was five years later—when, at his older brother Larry's insistence, his entire family packed up and moved to the island of Corfu—that Durrell's fascination with the natural world around him deepened dramatically. There, he could explore the streams and pools and fields and forests at will, learning through experience and observation the ways of nature. He was educated by private tutors, some of them notably eccentric characters, who wisely incorporated the child's hobby into his education, giving him a broad—if erratic—grounding in zoology. It was here Gerry created his first zoo, the denizens of which were often, to the family's consternation, allowed free rein of the house and grounds (and from time to time the bathtub, for those aquatically inclined); others inhabited matchboxes or small makeshift cages.

In 1945, Gerry took his first job in a real zoo, at Whipsnade just outside London. Two years later he travelled to the Cameroons on the first of what would be many animal-collecting expeditions conducted for various zoos. These trips took him to many countries, including Belize, Mexico, Australia, Mauritius, Madagascar, Argentina, and Malaya, looking for the rare and unusual beasts of the world.

In 1953 he published his first book, *The Overloaded Ark*, and followed it the next year with *The Bafut Beagles*. These chronicles of his journey to the Cameroons revealed an unsuspected gift; Durrell was a superb writer. He had a unique talent for bringing the exotic characters and creatures he encountered to vivid life with extraordinary insight and often side-splitting humour. His writing had an immediacy that made his readers feel that somehow they, too, were sweating in the jungle in the dark waiting for some tiny nocturnal lemur to appear, or frantically chasing around the heaving decks of a freighter after a loose monkey, or whirling around a village clearing in Bafut with the Fon and his many wives, drunk on palm wine and the magic of an African evening.

In all, he wrote 37 best-selling books, which have been translated into 31 languages. In addition to this impressive output, his radio and television specials and documentary series created an added dimension of sight and sound that did even more to communicate his message.

Because he certainly did have a message. In his travels, Gerry became increasingly disturbed by the damage he saw humans inflicting on nature. He saw habitats shrinking and species declining, and precious little being done about it. His books and films were produced largely in an effort to inform the public about the increasingly dire plight of many of the mammals, birds, reptiles, and amphibians he sought. They served another purpose as well. After years of working in zoos and collecting animals, his dream of having his own zoo was taking firmer shape. He had his own ideas about the way a zoo should be run and what, in fact, zoos should be for.

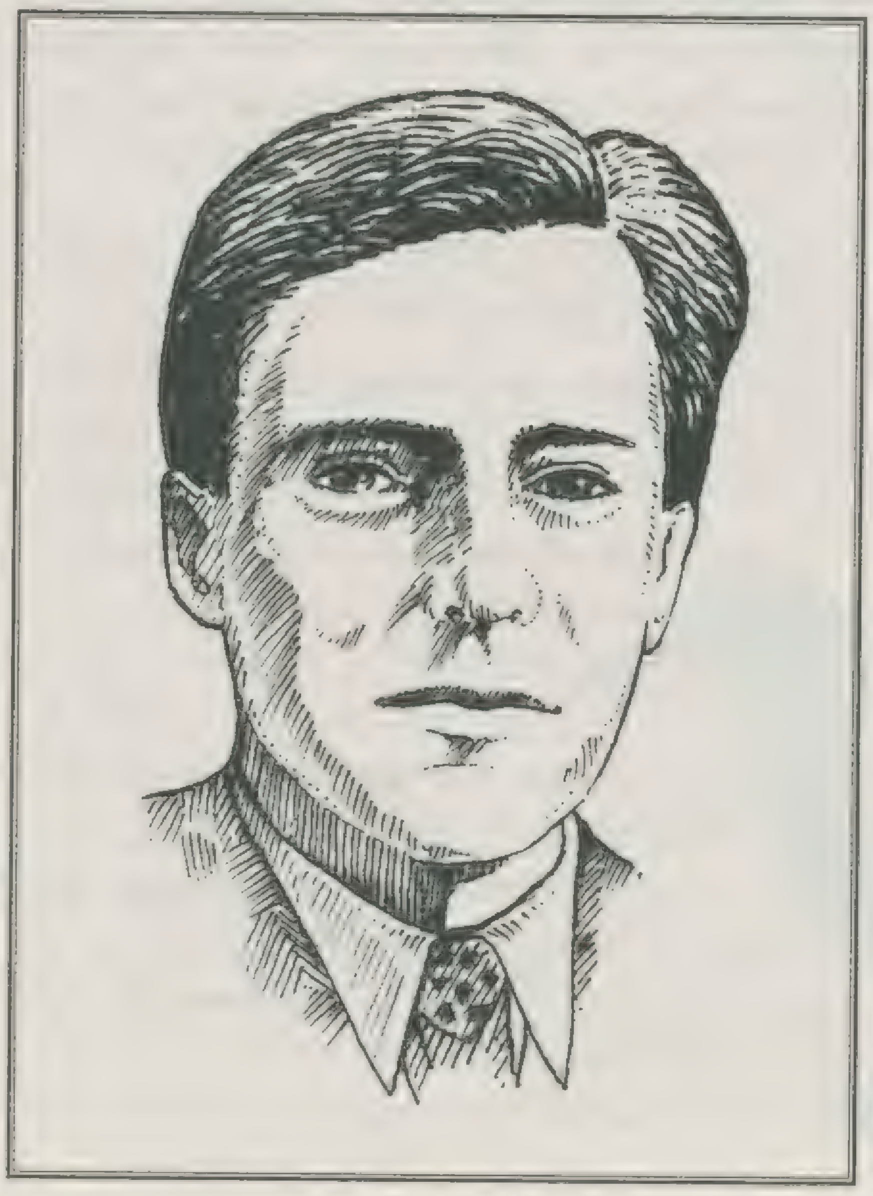
After a long search involving setbacks that might have stopped a less determined man, a stroke of luck at the eleventh hour led him to the island of Jersey, in the British Channel Islands, and the beautiful property of Les Augres Manor. With the manor house and 32 acres of undulating park and farmland, Gerry's dream had finally found a home.

At Easter of 1959, the Jersey Zoological Park was opened to the public. It was a zoo unlike any other—a zoo designed not for people, but for animals. It was the first zoo to focus on what Gerry saw as an absolute necessity for the survival of many species: captive breeding, with the view to eventually reintroducing them into the wild. His greatest strength was in this area, but he stressed the equal importance of preserving habitats, so that the animals he laboured to save would have some place to go. He was criticized at the time by other professionals in the zoo world, but he forged ahead. In time, his ideas about captive breeding and the importance of preserving species in zoos—while others, in the field, worked on habitat—brought about change in zoos the world over. The principles he established are now practiced as a matter of course.

In 1963 the zoo and its animals became part of the Jersey Wildlife Preservation Trust. As its emblem, Gerry chose the dodo, a harmless, flightless bird that became extinct less than 100 years after its discovery. It is a familiar, tragic symbol of man's inhumanity to his fellow creatures. Through determination and tireless efforts, the Trust has become internationally recognized and respected as a world leader in conservation work with endangered species of mammals, birds, reptiles, and amphibians. He established cooperative efforts with other zoos, working toward a more open exchange of scientific information and, indeed, of the animals themselves, to strengthen the gene pool of captive species.

Gerry had a broad vision that encompassed all aspects of conservation. Perhaps the most important element, without which hands-on captive breeding had only a limited chance of success, was education—getting the message to the people. To this end, he established Wildlife Preservation Trust International in the United States in 1975, and ten years later, Wildlife Preservation Trust Canada. These moves brought his vision to the people of North America, giving them opportunities to become more personally involved.

He also brought the world to Jersey, founding the International Training Centre (ITC) to provide conservation workers from many countries with intensive training in the principles and practice of captive breeding. The ITC also fosters an invaluable exchange of information and experience between concerned individuals who, though they come from remarkably diverse countries, share unfortunately similar problems. Many of these individuals come from, and return to, daunting challenges in remote corners of the world with little in the way of resources. The ITC can give them a much-needed boost, knowing they are not labouring in isolation.



A drawing of Gerald Durrell as a young man. Thousands read Durrell's books, including *The Bafut Beagles, My Family and Other Animals, The Drunken Forest,* and *The Whispering Land.* From these books the public learned to appreciate the smaller and more unusual animals of rain forests, grasslands, and islands, such as the Pygmy Scaly-Tail, (a kind of flying mouse), colourful agamid lizards, hairy frogs, orange armadillos, and guanicos (wild relatives of the llama). [Drawing by Jean H. McAllister.]

Gerry was, perhaps surprisingly, a rather shy man, but his passion for his work sometimes found him on gruelling lecture tours. One of these tours had an unexpectedly delightful outcome. While speaking in the United States he met Dr. Lee McGeorge, a zoology professor at Duke University, and they were soon married. Shortly after their marriage they took what amounted to an unorthodox extended honeymoon, travelling together around the world working on conservation projects (given the groom's unique history, perhaps it wasn't that unorthodox...).

Gerry, Lee, and the devoted staff of the Trust continued business as usual over the next fifteen years, starting new projects and watching established ones bear the fruits of success, spreading a message that was born of love and grew to a global vision.

Sadly, Gerry's years on the road, using every ounce of energy in pursuit of his dreams, took their toll. A few years ago his health began to fail. Driven by the sheer passion and determination that makes for true visionaries, he didn't let it slow him down. But last year he underwent a liver transplant from which he never fully recovered. He died on 30 January 1995, a few short weeks after his 70th birthday.

He left behind him a string of impressive honours, awards, and achievements:

- the Order of the British Empire, Honourary Doctor of Science from the University of Durham, Doctor of Humane Letters from Yale University, and Officer of the Golden Ark,
- thirty-seven books and dozens of television programs that touched the hearts and minds of millions
- a zoo with a stellar cast of scientists and experts
- an entire course of study at Kent University
- a training centre for dedicated young colleagues from around the world, and
- Canada's New Noahs program.

Today many creatures owe their existence to Gerald Durrell while others in great peril, at least, have a chance. All of this came from the vision of one man. Well, one boy, really. A little boy who looked at the natural world around him with wondering eyes, and never, never, lost that wonder.

"Look at it this way. Anyone who has got any pleasure at all from living should put something back. Life is like a superlative meal and the world is the maitre d'hotel. What I'm doing is leaving a reasonable tip."

The Trustees of Wildlife Preservation Trust Canada have established a special fund to continue the international conservation efforts instigated and inspired by Gerald Durrell. If you would like to contribute, please make your cheque payable to the "Gerald Durrell Fund for Wildlife" and mail it to the address at the beginning of the article. You may also use your VISA/MASTERCARD by sending your card number, expiry date, and a daytime phone number. All donations are tax creditable. A Memorial Service for Gerald Durrell will be held on 28 June 1995 at the Museum of Nature in London, England. This fall, a special evening honouring the life of Gerald Durrell will be held in Toronto. For further details on either of these events, please contact Wildlife Preservation Trust.

PART TWO

Canadian biodiversity successes and initiatives

***Global biodiversity** is pleased to present more examples of Canadian initiatives and successes in studying, conserving, sustainably using, or communicating about biodiversity in Canada or overseas. The role of this feature is twofold. First, to show that in spite of the many threats to biodiversity, some innovative and worthwhile projects are being undertaken. Second, the examples are intended to provide models for people in Canada and elsewhere to follow, adapt, or enhance. We hope these success stories will provide some light and encouragement amidst the encircling gloom, and we encourage readers to let us know about their biodiversity successes and initiatives here in Canada and around the globe. [D.E.M.]*

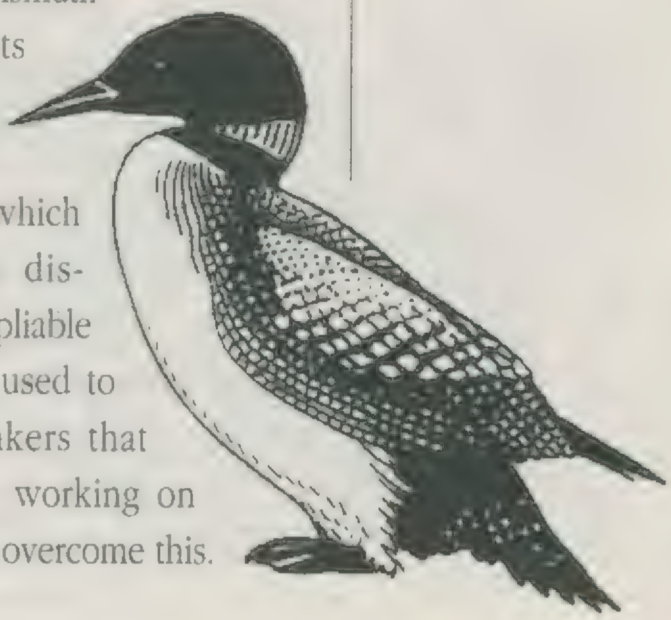
The Bi Logic Tackle Company: Getting the lead out of fishing

CONTACT: *Larry Kissau or Edward Paterson, Bi Logic Tackle Co., R.R. 3 Thessalon, Ontario, Canada, POR 1L0 Tel: 1-800-363-2369, (705) 841-2521 or 842-3367, Fax: (705) 841-2521*

An article in the *Canadian Lakes Loon Survey* (CLLS) 1991 Newsletter stated that over 50% of adult loons examined in a study, done at Tufts University School of Veterinary Medicine in Massachusetts, had died from ingesting lead fishing sinkers. This article really affected us because we own a resort that caters to fishers, fish ourselves, and enjoy watching the loons on the lake (and reporting their activities to the CLLS). On one hand, we were trying to do something to help the loons, but on the other hand, we were promoting an activity that could lead to the loon's demise.

Investigating this further, we found that studies had been done on over 50 species of wildfowl that had died from the ingestion of lead from one source or another, and that it was estimated that up to 3 million wildfowl died annually in North America from lead poisoning. Bald eagles and other raptors were found to have died from consuming other birds that had died or were suffering from lead poisoning. The Avian Care and Research Foundation in Verona, Ontario examined 52 Common Loons from 1981 to 1992. Six were confirmed as having been lead poisoned from ingested lead fishing sinkers. Four of these six were examined in 1991 and 1992 and represented 22% of the loons examined in these two years. By the end of 1994 they had recorded a total of 12 cases of lead poisoning from ingested fishing tackle.

Convinced that it was important to stop using lead, we searched for alternatives in stores and catalogues and found that there was not much available on the market. Working with a friend, Edward Paterson (a computer consultant for the North Shore Board of Education and a part time inventor), we began the search for an alternative to lead. We chose the metal bismuth and started the Bi Logic Tackle Co. to produce lead free sinkers and jigs and to make them available to the public. Bismuth was chosen because all data indicated a low toxicity and previous tests on research animals had favourable results (low residual levels in tissue and blood after only a short period of time). Bismuth has a relatively high density (its specific gravity is 9.78 versus that of 11.34 for lead), and has a low melting point (271° degrees C.), which makes it easy to mould. One disadvantage is that bismuth is not as pliable as lead and, therefore, cannot be used to manufacture certain types of sinkers that require this characteristic. We are working on new innovations in sinker design to overcome this.



The greatest disadvantage is the cost of the bismuth compared to the cost of lead. But to the average angler purchasing sinkers, the cost of using bismuth instead of lead will only be a dollar or two a year. This is a small amount compared to what the average angler pays to go fishing, and a small price to pay to prevent a needless loss of loons and other wildfowl, which enhance the fishing experience. What would a fishing trip be without the call of the loon echoing across the lake?

Fishing, both commercially and as a sport, leaves tons of lead in our lakes, rivers, and streams every year. If each licensed angler in Ontario lost just one ounce of sinkers this year, the waters would be contaminated with 62 tons of lead. Acid rain contains nitric acid and lead is soluble in dilute nitric acid. As the lakes become more acidic and the volume of lead increases, there is a possibility that lead could be absorbed in the water and passed up the food chain.

Also, lead-headed jigs are among the most popular lures today. Not only does this increase the amount of lead being left in the lakes, but now the fish are attacking the lead jigs. By breaking the line, they could possibly swallow the jigs whereas they seldom swallowed sinkers. Is it possible for the lead to affect the fish, or be absorbed in the flesh of the fish, which a predator or even a human may later consume? Information on any studies in this regard would be appreciated. If it was proven that "the big one" that broke the line might die anyway because of ingesting lead, we are certain that fishers would be more inclined to stop using lead in their fishing activities.

✔ The Canadian Field-Naturalist: 114 years of publication on northern North-American biodiversity

CONTACT: *Dr. Francis R. Cook, Editor, Canadian Field-Naturalist, RR 3, North Augusta, Ontario, Canada K0G 1R0. Tel: (613) 269-3211*

The CANADIAN
FIELD-NATURALIST

Published by THE OTTAWA FIELD-NATURALISTS' CLUB, Ottawa, Canada

Volume 108, Number 3

July-September 1994

The Canadian Field-Naturalist is the official publication of The Ottawa Field-Naturalists' Club and features papers and notes on original research and observations on the natural history of northern North America (including significant distribution records, faunal analyses, taxonomy, ecology, and behaviour). Issues also include news and comment (short items, including club and other awards; and longer ones such as minutes of club annual meetings, tributes, and review papers) and book review and new title sections. Since 1984, it has included edited Status Reports for selected individual species designated by the Convention on Species of Endangered Wildlife in Canada (COSEWIC). It is entirely supported through a percentage from club memberships and all proceeds from individual and institutional (library) subscriptions, as well as page charges and sale of reprints. In 1994, the Ottawa Field-Naturalists' Club had 1,033 paid members, and *The Canadian Field-Naturalist* had an additional 241 individual and 547 institutional subscribers with 227 in Canada, 270 in the U.S.A., and 50 in other countries, for a total paid distribution of 1,821 copies.

The Ottawa Field-Naturalists' Club was formed in 1879 by scientists from embryonic federal departments including the Dominion Experimental Farm, and shortly after, the Geological Survey of Canada, and leading amateurs; this type of mix remains its strength to this day. The Club quickly emphasized publication, and for seven years beginning in 1880, it annually issued the *Transactions of the Ottawa Field-Naturalists' Club.* With Volume (Vol.) 3 in 1887, the *Transactions* became a subtitle of Vol. 1 of *The Ottawa Naturalist*, a monthly publication. With Vol. 3 of *The Ottawa Naturalist* in 1889 the emphasis changed from local members reports to national ones, and in 1919 the journal was renamed *The Canadian Field-Naturalist* (starting with Vol. 33 = Vol. 35 of the Transactions but this subtitle was subsequently dropped). The issues per year were gradually reduced from 12 to 9 to 6 and eventually to 4, the latter beginning with Vol. 67 in 1953. However, the annual number of pages increased. In 1988 pages reached a record of 798 in Vol. 102, with a record single issue of 216 pages in 102(2). Since 1967, the Club has separately published a local (Ottawa area) natural history journal, *Trail & Landscape*, which is now also issued 4 times a year.

Submissions to *The Canadian Field-Naturalist* and predecessors have long been peer reviewed, first through a "Publishing Committee," later through "Sub-editors," and then through "Assistant Editors" until the designation "Associate Editors" was adopted in 1885 and maintained ever since. Currently, most submissions also go to one or more additional outside reviewer(s). Associate Editors are listed in every issue, and since 1982, other reviewers for each volume have been acknowledged annually in the Editor's Report. The latest publication policy was published in *The Canadian Field-Naturalist* 108 (1): 106-109, 1994. "Advice to Contributors" is published in one or more issues annually and includes full information on format and page charges. The current subscription rate is $23 for individuals and $38 for institutions. Postage outside Canada is $5.00 additional. Subscriptions should be sent to *The Canadian Field-Naturalist*, Box 35069 Westgate P.O., Ottawa, Ontario, Canada K1Z 1A2. Manuscripts should be addressed to the contact person listed at the beginning of this article.

✓ Biodiversity and organic farming

CONTACT: *Anne Macey, Canadian Organic Growers, P.O. Box 6408, Station J, Ottawa, Ontario K2A 3Y6, Tel.: (613) 259-2967.*

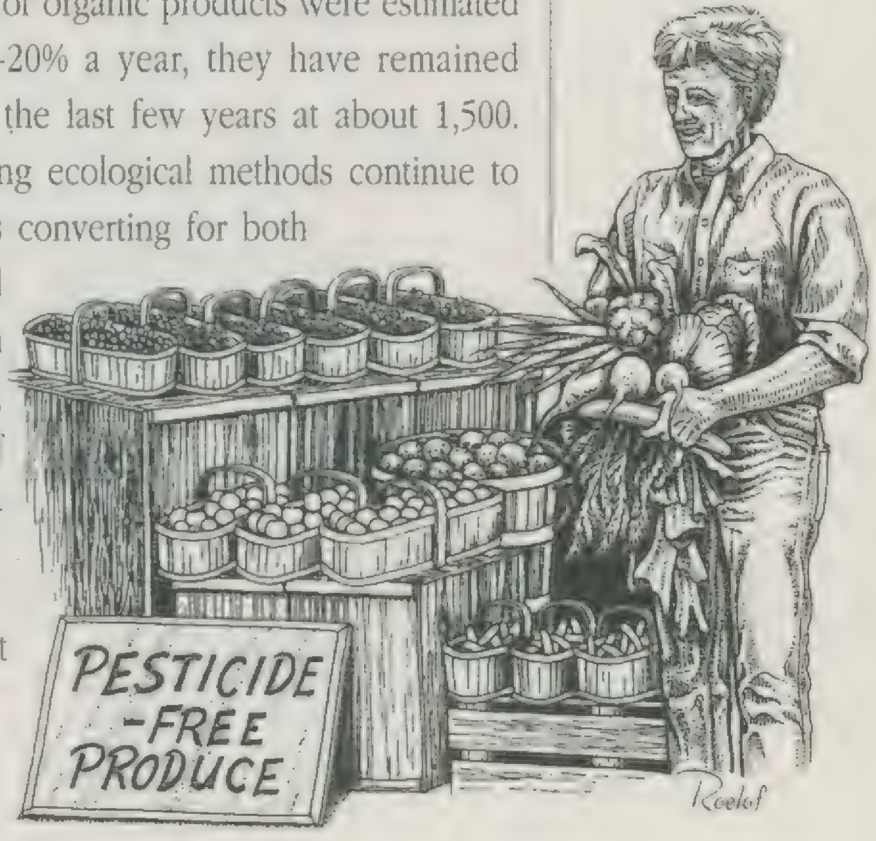
INITIATIVES: Across Canada and around the world organic farmers are helping to maintain and increase biodiversity in agro-ecosystems. Terms such as organic, ecological, biological and natural farming are used to describe farming systems based on ecological principles. These systems and practices seek to create ecosystems that achieve sustainable productivity and provide weed and pest control. This is achieved through maintaining a diverse mix of mutually-dependent life forms, through recycling of plant and animal residues, and through crop selection and rotation, water management, tillage, and cultivation. Soil fertility is maintained and enhanced by a system that optimizes soil biological activity as the means to provide nutrients for plant and animal life as well as to conserve soil resources.

Organic farmers attempt to incorporate the laws of natural ecosystems into the farm design and into their approach to problem solving. They are aware that, because of labour requirements and resource limitations, it is not practical to copy the diversity of a natural system. A compromise is achieved by using complex rotations with a variety of crops, by maintaining natural habitats on the farm, and by limiting livestock numbers so that the balance between crops and livestock is maintained. The diversity also creates an ecosystem that has biological checks and balances to prevent any one species of insect, weed, or disease from becoming a problem.

The vital role soil micro- and macro-organisms play in recycling, releasing, and storing plant nutrients is recognised by organic farmers. Soil life is dependent on the continual replenishment of organic matter. Techniques such as composting and crop rotation, which include green manures and cover crops, support and enhance the biological life of the soil. In turn, this biological life nurtures the crop and maintains soil structure.

More and more farmers are recognising the benefits of these methods, which help increase fertility while reducing the need for pesticides and highly soluble chemical fertilizers that can have adverse affects far beyond the farm boundaries. There are organic dairy, cashcrop, livestock, vegetable, fruit, and mixed farms—every type of farming is represented. While numbers of Canadian certified organic farmers (i.e. those selling their products as " Certified Organic") rose dramatically in the late 1980s when sales of organic products were estimated to be growing at 15-20% a year, they have remained relatively stable over the last few years at about 1,500. Total numbers adopting ecological methods continue to increase, with farmers converting for both environmental and economic reasons. In Quebec, for example, an estimated 11% of farmers employ ecological methods.

Although there has not been any notable increase in the



visibility of organic products on supermarket shelves in Canada, the last few years has seen a big increase in the numbers of organic farmers at farmers' markets. Organic farmers are also developing community shared agriculture (CSA) projects where farms establish a customer base in a nearby urban centre. (For further information on CSA, see "Shared farming—A boon for biodiversity" in *Global biodiversity* 4(1): 24-25.)

The indications are that direct marketing of organic farm products will continue to increase. It appears that more and more people want to know where their food comes from and also want to know that the farmers are taking care of their land. All this bodes well for biodiversity in agricultural ecosystems.

The Canadian Organic Growers publishes a quarterly bulletin entitled *Cognition* (available by subscription for $24/annum) and also maintains a mail-service library for members.

✓ The Heritage Seed Program

CONTACT: *Heather Apple, Heritage Seed Program, R.R.3, Uxbridge, Ontario L2P 1R3, Tel.: (905) 852-7965, Fax: (905) 852-5635.*

INITIATIVES: A serious situation is occurring around the world. People have stopped growing the older varieties of food crops in favour of modern hybrids. These valuable commercial varieties are becoming extinct at an alarming rate. There is also a steady loss of wonderful heirloom varieties. Seeds that have been kept in families for years are no longer finding members of the next generation to maintain them. When the older generation passes away, their seeds die with them. All these extinctions result in a serious loss in the genetic diversity of our food crops. It is important to maintain this diversity so that plant breeders will have an abundance of material to breed resistance to diseases and insect pests into our present crops. Today we are facing the additional challenge of finding varieties that are tolerant to pollution, acid rain, and possible climate changes.

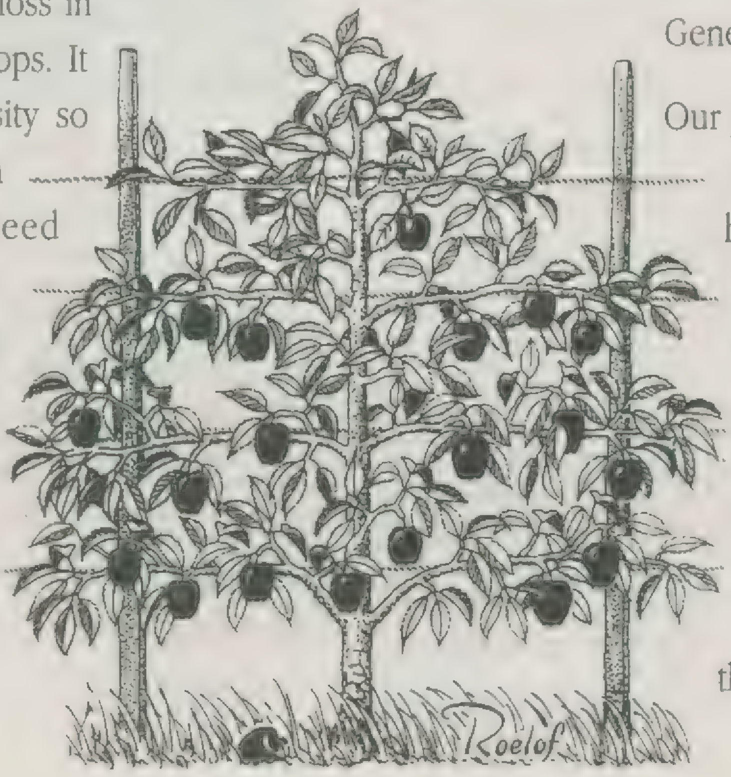
The Heritage Seed Program is a grassroots organization that searches out and preserves heirloom and endangered varieties of vegetables, fruits, grains, herbs and flowers. Our 1,900 members are backyard gardeners, farmers, historic sites, museums, horticultural historians, botanical gardens, and scientists. The heart of the Program consists of a network of growers—those members who grow endangered varieties in their gardens, practice the proper seed saving techniques to keep the varieties pure, save seeds, and make these seeds available to other members for free. In this way, someone, somewhere, is always growing these endangered varieties so that they will not become extinct. We are a living gene bank.

Three times a year we publish a magazine, entitled Heritage Seed Program, which has articles on heritage gardens, heirloom varieties, and seed companies that sell heirloom and regionally adapted non-hybrid varieties. Articles also examine projects in Canada and around the world that are working to preserve our horticultural and agricultural heritage. We also sell an illustrated booklet *How to Save Your Own Vegetable Seeds*, which outlines the techniques for saving vegetable seeds.

Each December we publish a Seed Listing of the over 1,200 varieties that our members are willing to share. This Listing is different from a seed catalogue in that we ask those who take seeds from it to grow the seeds, practice the proper seed saving techniques, and save seed to share with other members.

In 1992 we purchased a nursery that contains over 350 varieties of heirloom and rare fruit trees. It is now being established as a permanent preservation collection. We network and co-operate with other organizations involved with plant genetic preservation, and in 1991 we signed a Memorandum of Understanding with Plant Gene Resources of Canada.

Our ancestors have bequeathed us a rich agricultural and horticultural heritage of vegetables, fruits, grains, and herbs. These plants are delicious, nutritious, beautiful, and resistant to insects and diseases. With a little effort we can preserve these wonderful varieties and ensure that they will survive for the next generation to enjoy.



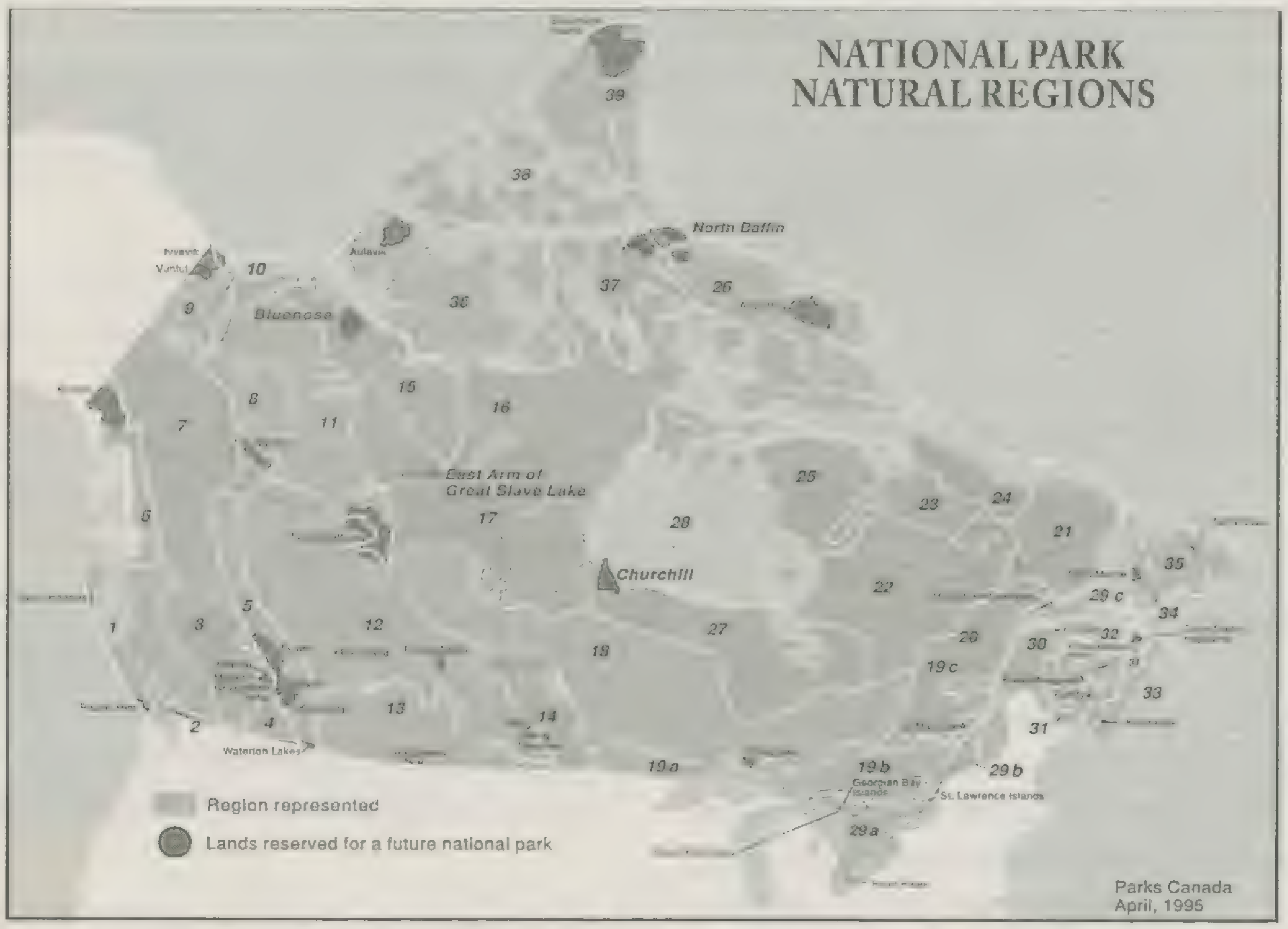
✓ Protection of Canada's biological diversity in the national parks system

CONTACT: *Bruce Amos, Director, Park Establishment Branch , Parks Canada, Department of Canadian Heritage, 4th Floor, Jules Leger Bldg., 25 Eddy St., Hull, Quebec K1A 0M5 Canada. Tel: (819) 997-4908, Fax: (819) 994-5140*

INITIATIVES: There are two general approaches to maintaining biological diversity: where it is found naturally (*in situ*), or removed from the site and kept elsewhere (*ex situ*). Maintaining native communities, species, and genes on-site—in their natural environment—is the only practical and cost-effective way to conserve a broad range of biodiversity.

The major contribution of Parks Canada to the protection of Canada's biodiversity is at the ecosystem level through the on-site maintenance of a partial sample of the country's ecosystems in the system of national parks. In the early 1970s, the Parks Service adopted a park system plan that divided the country into 39 natural regions based on the spatial patterns of physiography and vegetation. The goal is to protect a representative example of each region within the national park system by the year 2000. Of these, 23 are already represented (either by national parks or national park reserves and by the recent land withdrawal for a national park on northern Baffin Island). The current system is comprised of 36 units, with a combined total surface area of about 215,000 sq km, making it the largest protected area network in the country for safeguarding biological diversity in its natural setting at the ecosystem level.

At the species level, Canada's national parks protect a broad sampling of the country's native species and populations. Historically, national parks played an important role in restoring species near the brink of extinction, such as the American Bison (*Bison bison*) Wood Bison (*Bison bison athabascae*), and Pronghorn Antelope (*Antilocapra americana*). Parks Canada continues this tradition today, as many parks are active in the restoration of populations of species that have been designated by COSEWIC as either endangered or threatened. Some of these include the Wood Bison, Burrowing owl (*Speotyto cunicularia*), Anatum Peregrine Falcon (*Falco peregrinus anatum*), Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*), Piping Plover (*Charadrius melodus*), Whooping Crane (*Grus americana*), the Red Mulberry (*Morus rubra*) plant, among many others. National parks also conserve the habitats of vulnerable species that are native to Canada, such as the western populations of Grizzly Bear (*Ursus arctos*), Woodland Caribou (*Rangifer tarandus caribou*), Wolverine (*Gulo gulo*), the Trumpeter Swan (*Cygnus buccinator*), and the Hop Tree (*Ptelea trifoliata*). In a few instances, the national parks are being used to reintroduce extirpated species into their former range, for example, the Swift Fox (*Vulpes velox*) at Grasslands National Park.



Map showing the 39 natural regions of Canada. Courtesy of Parks Canada.

Black Rat Snake *(Elaphe obsoleta)* (Photo by M.E. Gartshore)

At the genetic level, Parks Canada is undertaking molecular genetic research projects to study genetic diversity in species such as the Newfoundland Pine Marten (*Martes americana atrata*), American bison, and the Black Rat Snake (*Elaphe obsoleta*). Knowledge at the genetic diversity level is fundamental for developing management strategies to conserve biodiversity and to provide for the ecological integrity of national parks.

Protecting, managing, and sustaining the integrity of national park ecosystems will be a major challenge in the coming years. Parks seldom encompass complete or unaltered ecosystems. This, combined with increasing and cumulative stress from various sources, such as adjacent land uses, downstream air and water pollution, invasion of exotic species, visitor use, and climatic change, can result in irreversible degradation of park ecosystems, the loss of biodiversity, and impoverishment of gene pools.

In response to this challenge, national park managers have adopted a more holistic view of the natural environment, recognizing that parks are not islands but part of larger ecosystems. To be effective, ecosystem management must have a broad base of support and be based solidly in science. Consequently, in collaboration with resource industries, Aboriginal peoples, environmental groups, other land management agencies, and researchers, parks are attempting to develop a better understanding of the relationship between existing land use practices and their effects on the environment and park resources. In turn, they are also examining how the management of parks influences the surrounding areas. Furthermore, parks are encouraging cooperative regional land-use planning and environmental monitoring. A number of different arrangements are in place to foster cooperation on an ecosystem basis: three national parks are core areas of UNESCO Biosphere Reserves, four are part of the "Model Forest" program, and most other parks are involved in other *ad hoc* ecosystem management approaches.

This relatively new emphasis on the ecosystem approach will see Parks Canada and other partners further applying the findings of science to the design and management of national parks, monitoring, trend analysis, and cumulative impact assessment in an effort to protect their valued ecological assets for this and future generations of Canadians.

Diverse quotations

Below are some quotations from the late Gerald Durrell, from *On the Edge*, newsletter of the Jersey Wildlife Preservation Trust. *On the Edge* also stated, "Durrell had little time for people who professed to be conservationists, but spent all their time flying from meeting to meeting. 'Decide what needs doing and do it,' could have been his motto." (John Burton, Ex Director, Fauna & Flora Preservation Society).

A sparrow can be as interesting as a bird of paradise, the behavior of a mouse as interesting as that of a tiger. Our planet is beautifully intricate, brimming over with enigmas to be solved and riddles to be unravalled.

My childhood in Corfu shaped my life. If I had the craft of Merlin, I would give every child the gift of my childhood.

I am glad to be giving something back to this earth because I've been so extraordinarily lucky and had such great pleasure from it.

People often tell me that they wish they'd lived a life like mine. I say: Why don't you? They then look rather abashed and mutter about how they had a mortgage and were saving up to buy a bigger house. The truth is they never had the confidence to risk it.

THREESPINE STICKLEBACK DIVERSITY

Revealing the origins of biodiversity and speciation.

Threespine sticklebacks, finger-long species of marine and freshwater fishes with needle-like spines on their backs, have fascinated students of behaviour and evolution. Their nest-building habits and courtship dances have contributed to ethology, while diverse populations bearing different numbers of plates, various colours, and life history patterns have contributed to the study of selection, evolution, speciation, as well as to scientific debate. We are still learning about these tiny, fascinating creatures. [D.E.M.].

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A small fish is helping scientists to understand the origins of biological diversity—the process of speciation. Speciation is what happens when a single species divides into two or more species. It is difficult to study in the natural world because of its historical nature: by the time we identify a species as such, the process has already occurred.

Fortunately, scientists have discovered varieties of fish so young that the process of speciation may still be taking place or has just taken place. These fish are threespine sticklebacks (*Gasterosteus aculeatus*). They are commonly anadromous (i.e. they spawn in freshwater but live as juveniles and adults in the sea), but have adapted to an entirely freshwater life in coastal lakes and streams in British Columbia, Canada. See Figure 1.

ORIGINS

How can an anadromous fish live throughout its life in lakes and streams? Throughout the vast range of the northern hemisphere, threespine sticklebacks have sometimes entered freshwater areas and established permanent populations that have then been cut off from the ocean. During the last ice age (about 15,000 years ago), the ocean levels were much higher due to extensive melting of the continental ice sheets. Marine fish, therefore, were able to invade coastal habitats. When the sea levels decreased, these fish were trapped in the once salty lakes and streams that were now changing into freshwater ecosystems. Since the freshwater environment is very different from the marine environment, obviously the sticklebacks had to change in order to live there. In some cases, they have changed so much that they don't even look like marine sticklebacks any more.

These new populations of sticklebacks often don't recognize their marine ancestors as potential mates. When populations of animals won't interbreed, we usually call them different species. Results from genetic tests show that many of these populations also represent distinct gene pools. Therefore, although these fish are descended from marine sticklebacks, some of them have become separate species in a very short period of time. In fact, they are among the youngest natural species that we know of!

UNIQUE POPULATIONS

This minor adaptive radiation of sticklebacks has resulted in populations that are diverse morphologically and ecologically. The fish in some populations are very large while others are tiny; some have lots of body armour, such as spines and plates, while others are virtually naked; in some populations, breeding males turn bright blue with red throats while males in nearby lakes are turning black.

The relationships among all of these different populations of sticklebacks is currently being studied. An especially interesting problem concerns the populations in five lakes on different islands in the Strait of Georgia. These lakes contain not just one, but two kinds of sticklebacks. One kind eats plankton and the other kind eats benthic invertebrates, such as snails and worms. These two kinds of fish live together in each lake but do not interbreed. They are genetically distinct from each other, and from their marine ancestors. This is remarkable because speciation usually requires geographic isolation. Without it, two closely related populations of animals usually interbreed and evolve into one species. Why hasn't this happened with these populations? Scientists are trying to find out so they can understand how the speciation process works.

AT RISK

But time appears to be running out for some of these populations. Because the populations with two species are so unique and valuable, some of them have been put on Canada's endangered species list. However, this does not mean that they are being legally protected. As it happens, all of these lakes are threatened to some extent by human encroachment. Some of the lakes are on land owned by logging and mining companies, and some are sought after by developers wanting to build golf courses and houses around them. Last summer, the only population on Lasqueti Island was wiped out by the introduction of catfish by a fish farmer. The catfish appear to have devoured all of the stickleback eggs in nests that are tended by males on the bottom of the lake. Nearby, on Vancouver Island, another population is also threatened by introductions. This time it's crayfish, which also eat the eggs of both species of stickleback.

The protection of the populations in the other three lakes rests solely on public education and the goodwill of the people whose land they are on. Hopefully, this is enough to ensure their survival. If it is not, then Canada's newest species may become the most recent extinctions.

SUGGESTED READING

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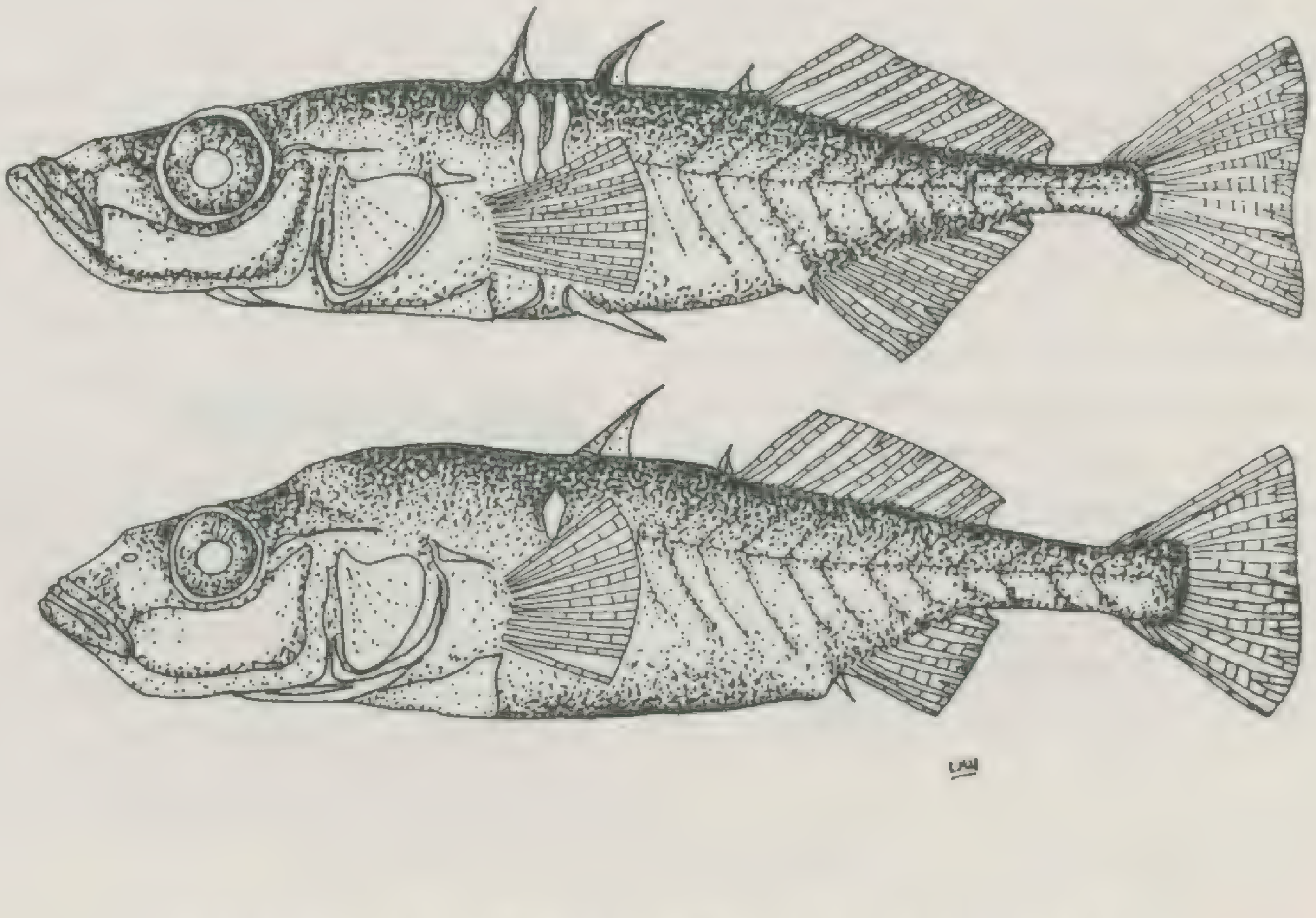

Figure 1. A newly evolved species pair of sticklebacks from Paxton Lake, Texada Island, British Columbia, Canada. These two species belong in the threespine stickleback complex, satellite forms of *Gasterosteus aculeatus.* The 'limnetic' or pelagic species is above, the 'benthic' or bottom species is below. [Drawing by Laura Nagel].

Legislative update: Endangered Species Act is under serious attack

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There are few laws in the United States that directly address the loss of biodiversity. For the last 20 years, the Endangered Species Act (ESA) has been utilized to confront ecosystem and habitat destruction, as well as the decline of individual species. This year the ESA has been targeted by the new Congress as the scapegoat of environmental laws. Described as ineffective, costly, and misdirected, the ESA is under an unprecedented level of attack from disgruntled members of Congress and biased industry representatives.

CONGRESSIONAL ESA TASK FORCES

In its first step towards revising the Act, the House Resources committee formed an "ESA Task Force," chaired by Republican Richard Pombo (R-CA). The members of the task forces have traveled to seven rural sites in the southeastern and western parts of the country to hear "real people" speak about the impact of the ESA on their lives. The task force has received heightened scrutiny after claims that the witness lists were one-sided. Scientists and most conservationists were denied the opportunity to publicly support the ESA. Instead, local landowners, industry representatives, and local government officials told "horror stories" about how the ESA has infringed on their private property rights.

In the Senate, the Environment and Public Works Committee has formed its own ESA Task Force to hold hearings in western states in early June. If these hearings are like the House task force hearings, then Congress will be legislating on the basis of unsubstantiated personal anecdotes rather than on sound science and policy.

HUTCHISON MORATORIUM

Earlier this spring, President Clinton signed a Defense Appropriations Bill that contained a rider delaying all final listing and critical habitat designations for six months. This rider included a substantial cut in the U.S. Fish and Wildlife Service's (USFWS) budget for the same activities. Although Senator Kay Bailey Hutchison (R-TX) had formally introduced a bill proposing the moratorium, she skipped proper committee procedure and successfully attached this rider to the larger Defense Appropriations package. This moratorium is expected to be extended again when it expires on 30 September 1995.

The moratorium impacts heavily on the species that have been proposed to be listed by the USFWS. Species like the Florida black bear are facing imminent harm, yet the prohibitions against killing them cannot be implemented while they await listing.

REAUTHORIZATION BILLS

To date, legislative language has not yet been introduced in the House. However, a bill is expected soon from Republicans Pombo, Young, and Tauzin that could significantly revise and weaken the goals and tools of species protection. Other ESA reauthorization bills are expected from more "moderate" members of the majority as well as from the Democratic minority. However, in light of the House passage of a very weak Clean Water Act earlier this session, a proactive ESA reauthorization bill is not expected to pass the House easily.

The Canadian Museum of Nature is pleased to provide an open forum for diverse viewpoints even though they may not represent the views of the Museum itself. Comments on these viewpoints are encouraged. Please mail or fax them to the editor (address on page 1).

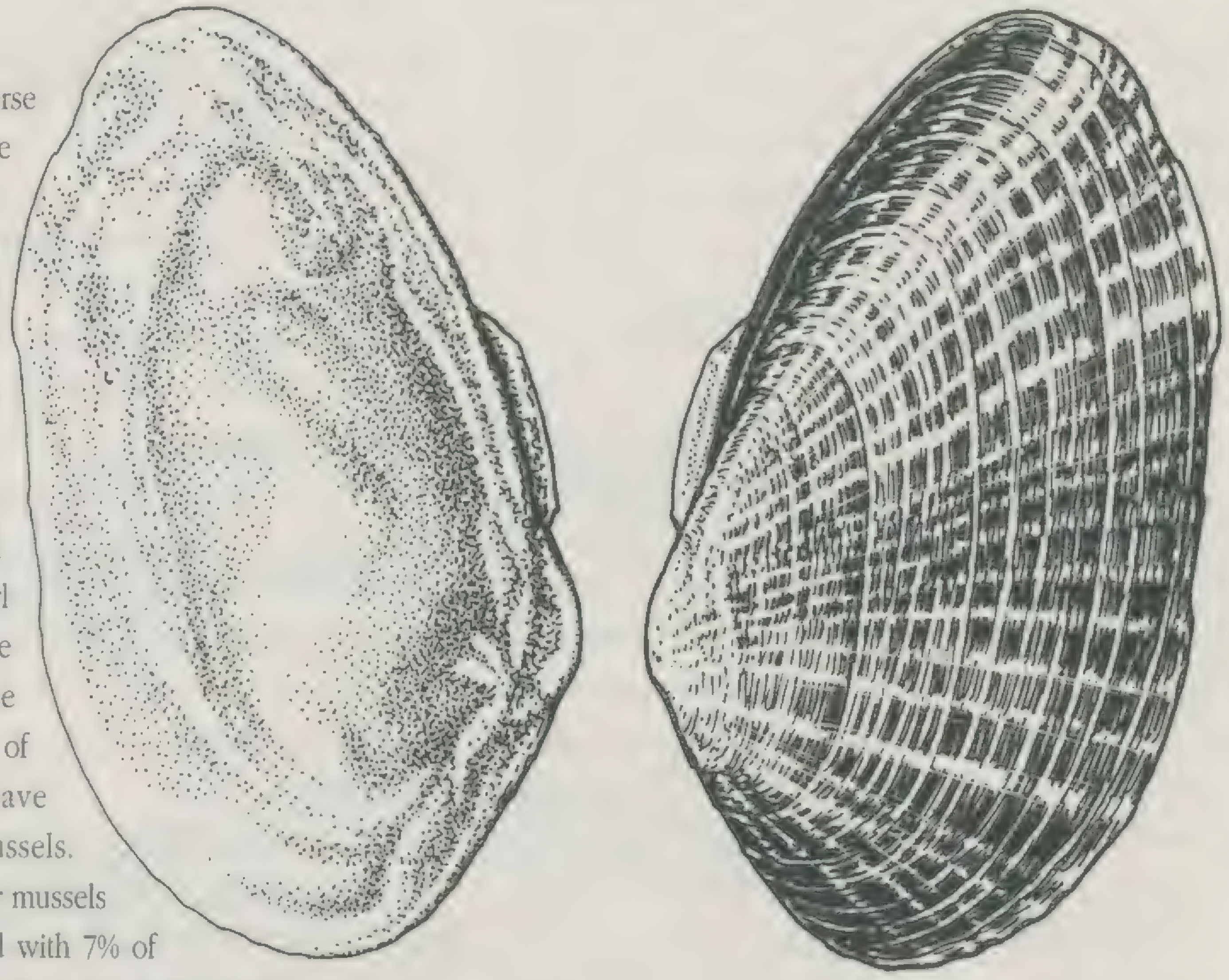
In the Senate, Senator Gorton (R-WA) has introduced one of the most radical alterations of the ESA ever seen in Congress. Co-sponsored by Senators Shelby, Johnson, Packwood, Lott, Breaux, Burns, Cochran, Thomas, and Warner, S.768 was introduced amid serious criticism of industry involvement in crafting the language of the bill. Although this bill is not expected to attract enough support in the Senate, other bills may adopt some of S.768's provisions, which would not only reverse current species protections, but encourage further harm.

For example, Gorton's bill would allow the Secretary of the Interior to choose his or her own "conservation objectives" in place of the current prohibitions against taking. The most heinous of the available options is to prohibit "intentional" killing while still allowing all incidental taking and habitat destruction. Even for the first 18 months a species is listed, only intentional killing is prohibited. The bill would also redefine "take" to only include direct injury, so that habitat alteration would be allowed when migratory species are gone. Gorton's bill would also revoke all recovery plans and require the Secretary to redetermine "conservation objectives" for each species. One objective, of course, is to let the species go extinct. Gorton's bill also would explicitly eliminate protection for most marine wildlife (excluding fish) in U.S. territorial seas unless it can be proven that the take was intentional. This appears to be written in direct response to the domestic regulations requiring "Turtle Excluder Devices" in shrimping nets.

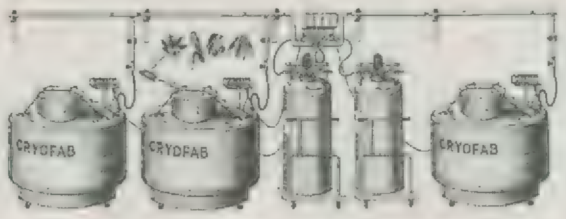
IMPLICATIONS FOR BIODIVERSITY

For many years the United States has claimed to be the pioneer in biodiversity protection. With the failure to ratify the Convention on Biological Diversity and now legislative efforts to undermine all wildlife protections, the U.S. may soon be regarded as "all talk and no action." There is also concern that if the ESA is effectively weakened, the U.S. will no longer be in compliance with CITES.

Much of this anti-ESA movement has not stemmed from the public's aversion to wildlife. Rather, it comes from a rejection of federal attempts to control state and local activities, and from a growing concern about the strength of the U.S. economy. Unfortunately, the victims of the attacks on the ESA and biodiversity are the voiceless members of future generations. For that reason, the ESA has become an easy target for disgruntled citizens and industry-supported members of Congress.



Rayed bean, *Villosa fabalis*
This species is only one of a formerly very diverse group composed of two families, Margaritiferidae and Unionidae, known as freshwater mussels, clams unionids, or naiads. Globally, the greatest diversity is reached in North America, where there are 297 taxa (281 species and 16 subspecies) recognised. However, this group is declining swiftly in the face of habitat destruction and adverse anthropogenic activities, such as pollution, damming, and commercial harvest for seed production for the Japanese pearl industry. The introduction in the 1930s of the Asiatic clam, *Corbicula fluminea*, and more importantly, the recent inadvertent introduction of the zebra mussel, *Dreissena polymorpha*, have hastened the demise of many indigenous mussels. Approximately 55% of North American freshwater mussels are recognised as extinct or imperiled compared with 7% of North American birds and mammals. The rayed bean has a relatively wide geographic range, in which it occurs only in small, scattered populations and is classified as being of **Special Concern** by the Freshwater Mussels Subcommittee of the American Fisheries Society Endangered Species Committee.



Species on ice

Thousands of species are becoming extinct every year. Conservation remedies, such as reducing human impacts and populations, preparation of endangered species listings, initiation of recovery programs, identification of species-rich ecosystems, and the establishment of protected areas have not yet reversed this erosion of diversity. Should we have a backup program, preserving genetic diversity in cryogenic banks? No one would say it would be easy to re-establish natural ecosystems from such banks, but at least cryogenic storage would provide a degree of insurance. [D.E.M.]

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Roughly 1.4 million of the Earth's species have scientific names, yet estimates of the total number of species range up to 30 million or more. As more than 5,000 species become extinct annually—some estimates reach an order of magnitude higher—we are running out of time to catalogue this living wealth.

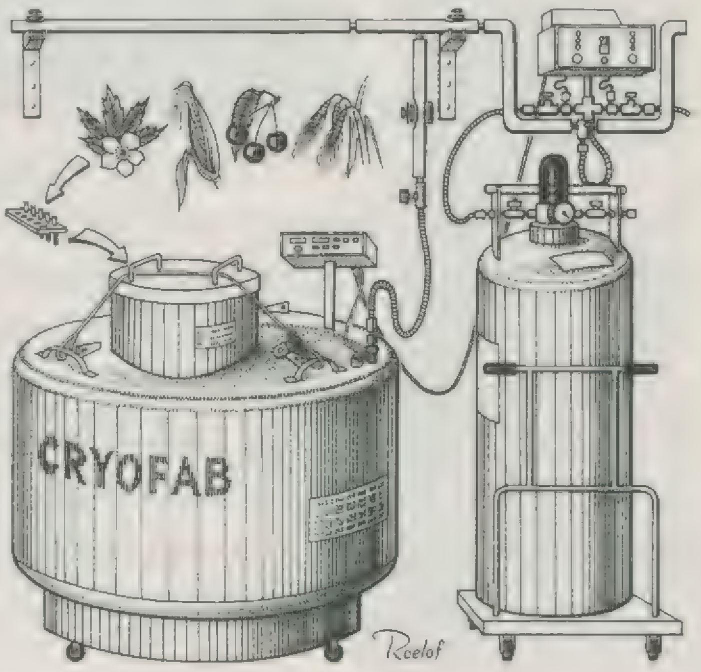
We are like browsers in the ancient library at Alexandria, who suddenly realize that the building has caught fire. Already a wing has burned, and the mobs outside will block any fire-fighting crews. What to do? There is no time to patrol the aisles, discerningly pluck forth a treatise of Aristotle or decide to leave behind Alexander the Great's laundry list. Better to run through the remaining library, tossing texts into baskets at random, sampling each section to give broad coverage. Perhaps it would be wise to take smaller texts, in order to carry more, and then flee into an unknown future.

It may be time to consider equally desperate measures to preserve our biodiversity. Captive breeding programs, parks, microhabitats, and zoos can preserve only a tiny fraction of our threatened species. Seed banks, germplasm and tissue culture collections, and programs devoted to preserving gametes, zygotes, and embryos mostly concentrate on saving traditional domesticated varieties. A triage system, by definition, would give up on some species as lost. But to save our biodiversity for future generations, we need to preserve samples of all threatened species. To collect those samples, we need a program that may strike some as fatalistic, but which is merely realistic.

I propose that the biological community systematically collect samples of plant and animal species from threatened natural habitats, and freeze them for long-term storage. This would be an emergency salvage operation rather than an inventory, for the samples would be minimally studied. There are far too few taxonomists to tally the world's species within our generation, let alone analyze them. But collecting without analysing requires minimal labour. The collections would simply be frozen at each site with ordinary ice or dry ice and later suspended in liquid nitrogen at long-term repositories.

How can we give future generations the opportunity to regain their lost biological heritage? The answer may lie in banking biological information *now* in cyrogenic storage.

We know that seeds can germinate after lengthy freezing and that microbes can sustain cryogenic temperatures. Simple cells, such as sperm and ova, survive liquid nitrogen preservation and function after warming. Generally, organs with large surface/volume ratios preserve well, such as skin and intestines. The current record for bringing the past alive in the genetic sense is DNA extracted from a fossilized magnolia leaf between 17 and 20 million years old. This feat defies predictions that DNA could not survive intact beyond about 10,000 years.



Only by preserving a wide cross-section of biota *in vivo* can we plausibly use much of the genetic library frozen *in vitro*. Therefore, we need a two-pronged strategy to salvage biodiversity from catastrophe. We need to keep alive some fraction of each ecosystem and its population at the genus level and freeze as many species related to those living systems as possible. This will allow future biologists to extract DNA from frozen samples and study the exact genetic source of biodiversity. Interesting genes from frozen species could be transplanted into living species from the same genus. Because gene pools will shrink in a ravaged environment, reintroducing diverse traits from frozen tissue samples could help species blossom anew, increasing their resistance to disease and the random shocks of life.

With such a "Library of Life," we may be able to gradually recover lost ecosystems by selectively reintroducing species. If nearly all of an ecosystem is lost, then the species library will provide a genetic "snapshot" of biodiversity at a given time and place, which evolutionary biologists can compare with the system as it has evolved much later.

We are at the same stage in the history of biological technology as the Wright brothers were in the history of aviation. For us to imagine and anticipate the Library of Life's potential uses would be as hard as it would have been for the Wright brothers to imagine a moon landing. Many biotechnological feats will emerge within a few decades—many ways of reading and using genetic "texts." But no advanced "reader" and "editor" can work upon lost texts.

Because much of the species gathering could be done by semi-skilled labourers, the bulk of the funding could come from debt-for-nature swaps. Such swaps would create a local work force that would profit from controlled, legal forest work, rather than from cutting.

Consider a sampling program that collects all life forms from a stand of a hundred trees, but not the trees themselves, for each hundred square kilometres of rain forest. If sampling each stand costs approximately $10,000 (probably an overestimate), then a million square kilometres would yield 10,000 stand-samples at a cost of $100 million. Sampling all the world's tropical forests, which cover about nine million square kilometres, would cost close to a billion dollars. A century's storage might cost another billion. By contrast, the current outstanding debt owed by tropical nations well exceeds $100 billion. Of course, this number does not include the cost of training biologists, transport, taxon discriminations, etc. But if the task is monumental, so is the probable benefit. Traditional economics cannot deal with transactions carried out between generations. As Harold Morowitz, a biologist at George Mason University, has remarked, the deep answer to "How much is a species worth?" is "What kind of world do you want to live in?"

Some may worry that a sampling and freezing program could compete politically with programs aimed at preserving habitat. I see no intrinsic reason why this should be so. The two kinds of programs yield different benefits over different time scales; they aren't logically part of a zero-sum game. Indeed, initiating a sampling program will powerfully illuminate the calamity we face. As the National Biological Survey proposed by U.S. Secretary of the Interior Bruce Babbitt swings into gear, we have the perfect opportunity to begin such a program. Akin to the U.S. Geological Survey, which has surveyed every square meter of the country, the Biological Survey promises to provide a coherent picture of our national biological riches. Freezing the survey samples would require only a simple added step.

The most difficult obstacle this plan may have to overcome is an attitude rather than an argument. Scientists are trained to be wary of speculation and of overstating our results—yet this training can hamper our ability to contemplate and labour to bring about change. Future generations might well try to recover their lost biological heritage. If scientific progress follows the paths many envision, they will have the means to perform seeming miracles. Simply by banking biological information, we can prepare now the broad outlines of a recovery strategy.

Such measures should be debated, not merely by biologists, but by the entire scientific community and beyond, for all our children will be affected. It is crucial for us to act now, as the Library of Life burns furiously around us.

As saviours of the Library of Life we are at best marginally literate; we can only hope that our children will be better readers, and wiser ones.

Gregory Benford teaches physics at the University of California, Irvine, and is the author of several novels. For further reading on the extinction of species, see *The Diversity of Life* by E.O. Wilson (Harvard University Press, 1992) and *Extinction: The causes and consequences of the disappearance of species* by P.R. Ehrlich and A.H. Ehrlich (Random House, 1981).

Reprinted from *Earthwatch* (July/August, 1993, pp 22-23), courtesy of its editor and the author.

Biodiversity news

A pollen grain, *Pavonia malvaceae*, member of the cotton family. (Photo by David Jarzen)

Palynology Reference Database and Catalogue Available

Palynology, a reference database of the Canadian Museum of Nature, contains Canada's largest pool of information on fossil and recent pollen and spore collections from around the world. The database documents all relevant taxonomic, collection, geographic, preparation, and photographic information about 15,000 species of plants. Geographic representation is worldwide with specific emphasis on tropical and subtropical regions. All specimens are from vouchered herbarium material and therefore, represent collections that may be referenced.

The database may be consulted for a variety of purposes, such as:

- Worldwide representation of angiosperms, gymnosperms, and pteridophyte plant taxa, providing a source of information on geographic variation in plant miospores
- Supporting morphological information in plant systematics
- Survey of plant family and/or generic distributions in time (fossil specimens) and space (fossil and extant)
- A research tool supporting other research techniques in elucidating the identity, affinity, and stratigraphic significance of fossil pollen and spores
- A reference tool in forensic studies where pollen/spores may be used to identify unknown specimens marked as evidence in criminal cases.

The database supports both English and French command structure; data are entered in English.

A **Pollen Exchange Catalogue** is also available. To receive a printed catalogue of all modern pollen slides available for exchange, write to:

Dr. D.M. Jarzen,
Palynology Laboratory,
Canadian Museum of Nature,
P.O. Box 3443, Station D,
Ottawa, Ontario K1P 6P4
Canada
Tel: 613 954-0355
Fax: 613 954-4724
E-mail: djarzen@mus-nature.ca

Dr. Jarzen may also be contacted for more information about the electronic access to the Palynology database and research programme and its connection to the Canadian Heritage Information Network (CHIN). This is now available on World Wide Web on the Internet at :

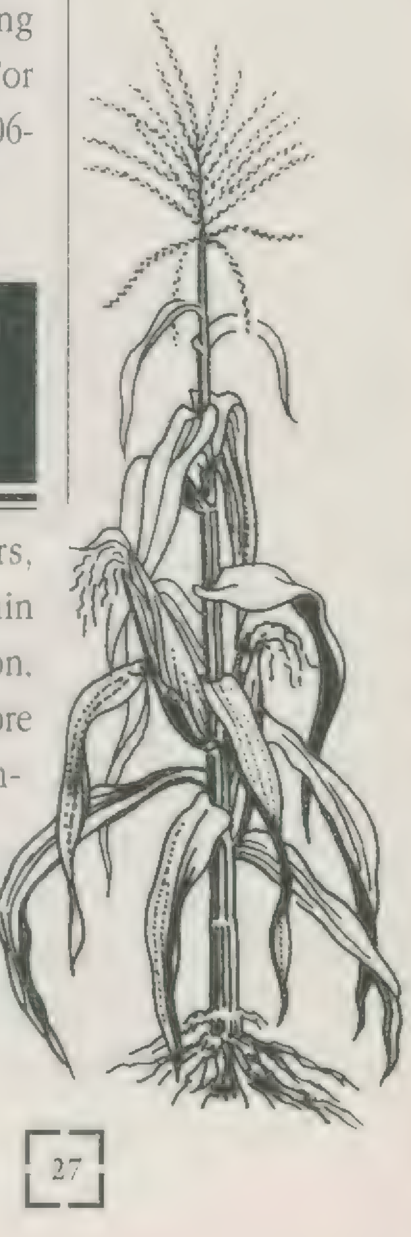
http://gpu.srv.ualberta.ca/~abeaudoi/cap/canmus.htm.

U.S. National Science Foundation Funds Taxonomy of Poorly Known Organisms

The National Science Foundation's division of environmental biology is offering grants to encourage studies of poorly known organisms. One aim is to help train a new generation of systematists, those biologists who carry out the crucial task of discovering, describing, naming, and classifying species. The program is called Partnerships for Enhancing Expertise in Taxonomy (PEET). For more information, phone (703) 306-1481.

Higher mineral levels found in organically grown produce

Organically grown apples, pears, wheat, corn, and potatoes contain 63% more calcium, 59% more iron, 125% more potassium, and 91% more phosphorus than their conventionally grown counter-parts, according to a report in *The Journal of Applied Nutrition.* [*Ottawa Citizen,* 29 December 1994, page E3]



Institute of Ecological Genetics to Study the Amazonian Biodiversity

A brand new Institute of Ecological-Genetics to Study the Amazonian Biodiversity has just been launched. Its main purpose is research, but it will also disseminate the "gospel" of international management of the world's most wonderful natural reserve. These two thrusts will aid in preserving the biodiversity in the Amazon.

The Institute is considering applications to fill posts as research scientific staff members. Evolutionary-biologists, geneticists, ecologists, systematists, botanists, zoologists, mathematicians, and other Ph.D. individuals interested in neo-tropical biological research will be considered. Individuals should have at least 10 years of research experience preferably, but not exclusively, in the tropics, and about 10 published scientific papers. For further information or to send your C.V., write to:

Dr. Hugo Hoenigsberg,
Instituto de Genetica-Ecologica y Biodiversidad Amazonica,
Cra.4 No.71-69,
Bogota D.C.,
Colombia.

Working on graduate degrees is also possible. For academic life within the Institute, please contact the Rector of the Amazonian University:

Dr. Ernesto Fajardo,
Universidad de la Amazonia.
Florencia, Caqueta,
Colombia.
Fax (988 35) 8231

Florencia is the capital of the State of Caqueta, and Caqueta is one of the three Amazonian States of Colombia. The Insitute will be working closely with Peruvian and Brazilian scientists interested in Amazonian biodiversity. The central offices and research labs will be in Florencia's surroundings. From Hugo Hoenigsberg. [Gregorio Melean <gmelean@kanojo.ivic.ve>].

JAMSTEC Studies Hydrogen Sulphide-Munching Bacterium and Develops Submersibles

Hydrogen sulphide is a toxic substance generated by a number of industrial processes. But some of the species that live around hot-water vents in the floor of the sea carry in their guts a special bacterium, which not only tolerates hydrogen sulphide, but can process it into carbohydrates. These and other microorganisms are under study by the Japanese Marine Science and Technology Centre (JAMSTEC), an arm of the Science and Technology Agency.

JAMSTEC is also developing deepsea submersibles. One of their models, the *Shinkai* 6500 can dive to depths of 6,500 metres. Another model, the *Kaiko* is able to go into the ocean's deepest trench, the Mariana Trench, found where the Pacific Plate sinks under the Philippine Plate. It has taken photos as deep as 10,910 metres, deeper than Mt. Everest is high. [*Women in Natural Resources* 16(1), 1994].

Photo of submersible. (Photo by Don E. McAllister)

World Wildlife Fund (WWF) Canada Proposes Reduction in Pesticide Use

Citing the harmful effects of pesticides on biological diversity, WWF Canada has called for an aggressive national policy to reduce pesticide use by at least 50% by the year 2000.

Pesticides have been directly linked to the decline of a number of Canadian wildlife species, such as the peregrine falcon, the burrowing owl, and many other species, including microscopic organisms and insects critical to healthy ecosystems. Humans are also impacted by chemical pesticides. Severe poisoning, cancer, and reproductive problems are among the effects on humans that have been documented. In a Fall 1994 report, *A Pesticide Reduction Policy for Canada,* WWF noted that European pesticide reduction programs have been tremendously successful and should be used as models here in Canada. The European programs aimed at a 50% reduction or more within a five-year period. "Europe is proving that dramatic pesticide reduction is possible," said Julia Langer, Manager of WWF's Wildlife Toxicology Program. "Getting rid of chemicals makes good economic and ecological sense, and consumers want it."

Thirty-four million kilograms of pesticides were used in Canadian agriculture in 1990 at a cost of $219 million. Smaller quantities were used in forestry, urban areas, and industry. Pesticide use, especially the use of herbicides, continues to increase despite the fact that pest problems often persist after pesticide use. Only a small fraction of the pesticide used

(0.1%) actually reaches the target pest while the remainder is dispersed into the environment.

Pesticides have been directly linked to the decline of a number of species, such as the burrowing owl.

WWF will be working with farm groups, pesticide manufacturers and distributors, and policy staff in the federal and provincial governments to develop laws, financial programs, and agricultural research aimed at an ambitious pesticide reduction program in Canada. Consumers can also play a role by creating a market for organic foods and products and by reducing their own use of pesticides. [World Wildlife Fund Canada's *Working for Wildlife*, Winter 1994 issue, page 3]

The European Union seems to have been much more environmentally active than the North American trade area. But it would still be possible to add forward-looking protocols to the recently signed North American Free Trade Agreement (NAFTA). [D.E.M.]

ICBG to Explore African Rain Forest

The Walter Reid Army Institute of Research will launch a mission to Africa to explore the rich biodiversity of the second largest continuous rain forest in the world. The purpose is to investigate Africa as a source of new molecular leads for drug development and its biodiversity as an important economic resource for communities inhabiting the area.

The collaborators in the International Cooperative Biodiversity Group (ICGB) include the University of Yaounde, Cameroon, the Smithsonian Institute, the Biodiversity Support Program, Shaman Pharmaceuticals, Bristol-Myers, and Squibb Pharmaceutical Research Institute. The ICBG strategy is to use data from field ethnobotanical and etho-medical studies as well as existing chemotaxonomic and pharmacological publications, thus generating a prioritized list of plants for investigation.

A large quantity of biological samples will also be mass screened to identify active compounds, which will then be isolated and characterized for further development. The regions to be explored include the rain forest of Oban Hills in Southern Nigeria and the Korup forest range of Cameroon, covering some 2.8 million square miles in the West and Central African region.

Group members from the Smithsonian Institute will install a large-scale permanent forestry plot, and the Korup National Park of Cameroon will provide the sites for forest dynamic research. Here, scientists will assess the local abundance, distribution, and dynamics of trees and shrubs with medicinal properties. They will evaluate the feasibility of sustained collection or harvest of these species from the natural forest or plantations. Systems for cultivating the medicinal plant, *Ancistrocladus*, source of the anti-HIV agent Michellamme B, will also be developed through this project. Africans will be trained in relevant areas through organized courses and participate in the installation of the forest plot. [*African Diversity, Seeds of Survival* Number 10, page 1, October 1994]. The article makes no mention of sharing benefits from products with the countries of origin. [D.E.M.]

Species 2000: Indexing the World's Known Species

Species 2000: Indexing the World's Known Species is a new programme launched by the International Union of Biological Sciences (IUBS) at its General Assembly in September 1994. It will operate in cooperation with ICSU Committee on Data for Science and Technology (CODATA) and the International Union of Microbiological Societies (IUMS), as well as interacting with the existing DIVERSITAS and Bionomenclature programmes of IUBS.

Species 2000 aims to enumerate all known species of plants, animals, fungi, and microbes on Earth as the baseline dataset for studies of global biodiversity. The names of these species provide the crucial link both in the communication of biodiversity information, and in accessing the data of pure and applied biological disciplines. The objective is to facilitate the creation of global master species databases, by augmenting existing taxonomic databases, and where appropriate, establishing new systems.

The output will be an important element in the information needed for the implementation of the Convention on Biological Diversity, providing support for the preparation of surveys and inventory of biodiversity, and a common medium for global communication about biotic resources, their utility, and conservation.

Implementation of Species 2000 will involve:

- forming a federation of existing taxonomic databases,
- establishing a user access framework and common gateway to member databases using electronic and non-electronic media,
- stimulating the establishment of global master species databases for all groups of organisms, by accelerating the completion of existing systems and developing new ones,
- working to an ultimate goal of providing a computer-based index of all known species,
- developing procedures both to maintain the databases and to update the taxonomy,
- cooperating with international nomenclatural authorities in stabilizing nomenclature.

Thus, the Species 2000 programme will provide a clearing house for taxonomic data on the world's known species.

Global master species databases, as envisaged here, are those that:

- cover a group of organisms worldwide,
- include structured information for all known species in the group, in particular names and synonymies,
- provide links to any species-relevant information such as; common names, descriptions, images, hosts or sub-strates, geographical or ecological distribution, threats, uses, chemical or molecular data, germplasm sources, and identification aids,
- subject records for each species to expert taxonomic scrutiny, with regard to the distinctness and appropriate position of the species within a consistent taxonomic hierarchy.

Species 2000 seeks federation holders of taxonomic databases as members. Taxonomic databases contain data relevant to specified taxa, designated by scientific names and including synonyms; they need not be worldwide in coverage or primarily taxonomic in purpose.

The Species 2000 Programme will develop rapidly during 1995. Funding proposals will be made, contacts established with prospective members, and a discussion meeting will be held for both the users and holders of existing taxonomic databases.

For further information, contact:
Species 2000 Secretariat,
Biology Department,
University of Southampton,
Southampton, SO16 7PX,
UK.
Tel: +44 1703 592444;
Fax: +44 1703 594269,
E-mail: sp2000@soton.ac.uk

Initial Steering Committee:
Frank Bisby (Chair), ILDIS, University of Southampton, UK; *Chris Thompson* (Vice-chair), BIOTA, U.S.D.A. Systematic Entomology Lab, USA; *Peter Schalk* (Secretary), ETI, University of Amsterdam, The Netherlands; *Simon Duffield* (Project planning), University of Southampton, UK; *Lois Blaine*, ATCC, American Type Culture Collection, USA; *Mike Boulter*, Fossil Record, University of East London, UK; *Werner Greuter*, Liaison with IUBS Bionomenclature Programme; *David Hawksworth*, President, IUBS; *Larry Speers*, Agriculture and Agri-Food Canada, Canada; *Nigel Stork*, Liaison with IUBS DIVERSITAS Programme

Request for Biosystematic Literature

The Association of Systematic Collections (ASC) is embarking on a second round of obtaining biosystematic literature for the Biodiversity Information Exchange with Cuba Project. This time, acquired literature will be distributed to institutions outside of Havana. In trying to build biodiversity information resources (including marine biodiversity), Cuban research institutions have a great need for current and back issues of taxonomic journals and other ecological and biosystematic literature. To donate and for more information, please contact:

Elizabeth Hathway,
ASC,
11th Street NW,
Second Floor,
Washington, D.C..
20001-4521
U.S.A.
Tel: (202) 347-2850.
Fax: (202) 347-0072.

Petition for the Rights of Future Generations

A petition is being circulated by the Cousteau Society calling on all of humanity to be responsible stewards of the planet as a fundamental duty of each generation to those of the future. It asks all leaders of States to exercise their influence to have this petition taken into account by the General Assembly of the United Nations. For more information write: Cousteau Petition, P.O. Box 2858, Norfolk, Virginia, U.S.A. 23501-2858. [*SusPop News*, January 1995, 11: 8]

Canada's Foremost Dinosaur Expert Retires, Migrates South

Dale Russell, one of the world's top researchers on the life and times of the dinosaurs and their environments, retired on 31 May 1995 after spending 30 years with the Canadian Museum of Nature (CMN). Russell is the author of more than 80 peer-reviewed publications and 2 books on dinosaurs. His best-selling and critically acclaimed *An Odyssey in Time: The Dinosaurs of North America* (University of Toronto Press, 1989), illustrated in paintings by his long-term artist collaborator Ely Kish, was nominated for a Governor-General's Award for non-fiction books in 1990.

Russell, a young Ph.D., was hired from Columbia University in 1965 and went off almost immediately to northern Canada to collect Cretaceous fossils in the vicinity of the Anderson River, Northwest Territories. Since then he has hunted dinosaurs and data on the environments in which they lived in Arctic and western Canada, the US, western Europe, Indonesia-New Caledonia, New Zealand, northern China, east Africa, Argentina, Egypt, and Morocco. A five-year fieldwork exhibit, and intellectual collaboration between the CMN, the Royal Tyrell Museum of Paleontology, the Academia Sinica in Beijing, and the Ex Terra Foundation resulted in the major exhibit "The Greatest Show Unearthed," now traveling worldwide.

Dale Russell (Photo by *The Ottawa Citizen*)

Like his fieldwork, Russell's research interests have been global. He was a central figure early in the debate over an extra-terrestrial cause for the extinction of the dinosaurs, bringing together top minds in many disciplines for two seminal workshops on the topic, sponsored by the CMN in 1976 and 1982. Russell is widely known for his outstanding contributions in the field of dinosaurian biogeography, and to the understanding of dinosaurs as a significant component, but still only part, of the biodiversity of now-vanished ecosystems. (For more on this, see "Dinosaurs through 175 million years" in *Global biodiversity* 3(4): 8-12.)

Russell is a widely sought-after lecturer, and his facility with audiences of all ages and backgrounds will serve him well as he "retires" to a five-year joint appointment as Visiting Professor at North Carolina State University and North Carolina State Museum of Natural Sciences in Raleigh. He is continuing several joint research projects with colleagues in the Planetary Evolution Centre at the CMN, where he will retain a formal association as Research Associate and as Researcher Emeritus. [Steve Cuumba, CMN]

Wildlife Habitat Canada Launches New Forest Biodiversity Program

Wildlife Habitat Canada (WHC) recently announced an innovative new program for forest companies in an effort to protect biodiversity. The WHC Forest Biodiversity Program will provide companies with the ability to collect the necessary information for the national certification process initiated by the Canadian Standards Association. It is the first major industry initiative on biodiversity in Canada since the 1992 Earth Summit. Several of Canada's largest forest companies are participating in the five-year program.

Forest companies in Canada have been facing a dilemma. They are being asked to develop Sustainable Forest Management plans that will maintain forest biodiversity and protect ecosystem processes in their woodlands. But many of them lack the scientific criteria and necessary information needed to do so. The goal of WHC's Forest Biodiversity Program is to ensure that forest companies can prepare such plans.

This announcement marks the beginning of a new role for Canadian forest companies in the maintenance of forest biodiversity. Each participating company will voluntarily contribute a percentage of its revenue from forest products to a trust fund administered by WHC. This money will be used to finance forest biodiversity research. All research will be approved and monitored by a National Steering Committee made up of members of the forest industry and WHC.

"Lack of information on forest biodiversity is becoming the Achilles heel of the forest industry in Canada," says Dave Neave, Executive Director for WHC. "...it is essential that we work with industry to develop scientifically sound ways of better managing our forests. Together we can compile biological inventories, prepare ecological maps, and develop clear biodiversity indicators that will help us measure change." [WHC]

For more information on this new program, contact:

Dan Donovan,
Corporate Manager, WHC,
7 Hinton Ave. N., Suite 200
Ottawa, Ontario K1Y 4P1
Canada
Tel: (613) 722-2090
Fax: (613) 722-3318

OUR READERS WRITE...
From David Punter, Head of Department of Botany, The University of Manitoba.

"...I was pleased to see in the latest issue of *Global biodiversity* that you featured our Manitoba floral emblem, giving reference to several common names. It is unfortunate that the greatest play in these parts is given to the name with the least botanical authenticity. Either Prairie Anemone, indicating its taxonomic associations, or Pasque Flower, denoting phenology (flowering around Eastertide), would be preferable to the taxonomically incorrect and confusing "Crocus" connotation.

"While on the subject of *Anemone patens*, I must draw your attention to a significant inaccuracy in the information on page 43. The flowers are not 'replaced with a cluster of silky white hairs bearing the seeds'; rather the carpels, each with a single ovule, after fertilization develop into achenes (single-seeded fruit) tipped by elongated and persistent styles (the silky white hairs) while the other flower parts fall away."

Cyberdiversity:

Biodiversity and the Internet

BIODIV-L: An Active Biodiversity Discussion List

The goals of BIODIV-L are to discuss technical opportunities, administrative and economic issues, practical limitations, and scientific goals leading to recommendations for the establishment of a biodiversity information network. Individual contributions are requested, not only to network capabilities, but also as to existing databases of interest to biodiversity.

The topics in the list's table of contents have included, for example, collaboration with biology student groups, announcement of a World Wide Web (WWW) General Science Resource, coastal rainforests of B.C., Canada, job annoucements, biomass of invertebrates, Gary Larson favourite cartoon, zoological collections, Carnivorous Plant Taxonomic Database, Neotropical Ichthyological Society meeting, World Biodiversity Database series on CD-ROM, a Russian Steppes meeting, and population viability analyses. In February there were over 500 non-concealed subscribers to the list. In the last week of February, there were 14 postings, but by March BENE (see below) was more active.

To subscribe to BIODIV-L send to <listserv@ftpt.br> an e-mail message:

subscribe biodiv-L <your e-mail address>

The list server will provide you with a temporary password, which you can then change. Subscribers can send contributions, list the table of contents of contributions, or download individuals' contributions, obtain list of subscribers with e-mail addresses, as well as un-subscribe.

This looks like an active and worthwhile biodiversity discussion group. [D.E.M.].

Biodiversity and Ecosystem Network (BENE)

The Biodiversity and Ecosystem Network (BENE) is sponsored by Texas A & M University, the Smithsonian Institution, and others. Information can be obtained at:

listproc@straylight.tamu.edu

Endangered species information now available through Internet

The Fish and Wildlife Service in the United States recently placed several electronic information items on its Information Resources Management Library Server, which makes these items accessible to users of Internet and the Service's Wide Area Network. These items include:

- The List of Threatened and Endangered Species (entitled, "Endangered and Threatened Wildlife and Plants"), current as of 30 June 1994, and to be updated monthly;

- The Plant Notice of Review (entitled "Plant Taxa for Listing as Endangered or Threatened Species, Notice of Review"), as published 30 September 1993
- The Endangered Species Act of 1973, as amended through the 100th Congress
- Species maps that indicate listed species and proposed species by state and territory
- Species maps that indicate Category 1 listing candidates and candidate species by state and territory, current as of 31 December 1993.

The Library Server can be accessed through cc:mail within the Service and through Internet e-mail software from outside the Service. If you address a new cc:mail message to R9IRMLIB (the Library Server's cc:mail address), type the retrieval command—Send ES Instructions—on the subject line and send the message, you will receive the complete list of "send" messages (retrieval commands) available on the Library Server for the Endangered Species Program. This list will change over time as more information is added to the Library Server. For example, the new Animal Notice of Review will be added once it has been published in the *Federal Register*.

Those from outside the Service with Internet e-mail capabilities should use: R9IRMLIB@mail.fws.gov (the Library Server's Internet address) to access the above information.

CITES-L

The list will provide a medium for discussions on wildlife trade and related issues to the Convention on International Trade in Endangered Species (CITES). The World Conservation Monitoring Centre (WCMC), where the list will be maintained, has had over 12 years of experience in dealing with wildlife trade issues and maintains a database of all reported trade in CITES-listed species on behalf of the CITES Secretariat. WCMC has regular contact with the CITES Secretariat in Geneva, which will also be a source of up-to-date information. The 9th Conference of the Parties of CITES will be held in November 1995 in Fort Lauderdale, Florida, and we hope to post decisions and results of discussions as they take place.

If you are interested in joining the list then please read on for further instructions.

Messages sent to CITES-L are distributed automatically and authors are solely responsible for the content of their posts. WCMC and CITES does not verify the accuracy of submitted messages nor endorse whatsoever is expressed. After joining CITES-L, please feel free to introduce yourself and the work/studies you are actually engaged in or general areas of interest.

To suscribe, send a one line message to LISTPROC@WCMC.ORG.UK with the command line (in message body):
SUBSCRIBE CITES-L <Yourname>
e.g. SUBSCRIBE CITES-L Ronald MacDonald

To sign off, send a one line message to LISTPROC@WCMC.ORG.UK with the command line (in message body):
SIGNOFF CITES-L
or
UNSUBSCRIBE CITES-L

CAUTION: Replying to a message from the list will reply to *everyone* on the list unless you take precautions to make sure that does not happen. Thank you for your attention. If you have any questions please direct them to the list manager:

Helen Corrigan
Wildlife Trade Monitoring Unit
World Conservation Monitoring Centre
219 Huntingdon Road
Cambridge CB4 3AH,
U.K.
Phone: +44 223 277314
Fax: +44 223 277136
E-mail:helen.corrigan@wcmc.org.uk

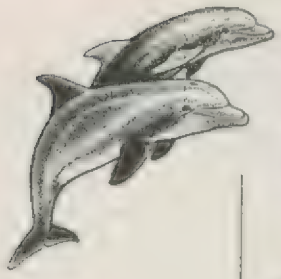
Environmental Legal Information Base (ELIB) on the WWW

The West Coast's ELIB can now be accessed by anyone in the world via Internet. Several persons can now dial in at one time. ELIB is a WWW site. Currently ELIB contains West Coast Environmental Network Research Foundation publications and newsletters. By the time this issue is published, ELIB should also contain a collection of statutes, catalogue references, publications of other organizations, and interactive collections on protection of private land and environmental assessment.

ELIB's URL (location) is:

http://freenet.vancouver.bc.ca/local/wcel

It can be reached using a World Wide Web browser such as Mosaic, Netscape, or Lynx; select File, Open, or GoTo to browse this URL. [WCEL News, 18(6): 1, 20 January 1995].



Biodiversity meetings

AUGUST 1995
AI and the Environment, to be held in Montreal, Canada.

An international workshop on the application of artificial intelligence technologies to environmental problems. We seek papers reporting work in this area, and people interested in the topic to attend.

Contact:
http://icwww.arc.nasa.gov/ic/conferences/IJCAI-Environment.html

AUGUST -NOVEMBER 1995
Workshops in Ecologically Responsible Forest Use, to be held in the West Kootenays of British Columbia, Canada.

- 14-18 AUGUST: "Practical Forest Hydrology"
- 28 AUGUST-1 SEPTEMBER: "Overview of Ecologically Responsible Forest Use"
- 11-15 SEPTEMBER: "Ecologically Responsible Forest Use at the Stand Level, Module 2"
- 25-29 SEPTEMBER: "Landscape Analysis and Planning for Large Forest Areas"
- 20-24 NOVEMBER: "Ecological Economics and Cost/Benefit Analysis"

Contact:
Susan Hammond
Silva Forest Foundation
P.O. Box 9
Slocan Park, B.C. V0G 2E0
Canada
Tel: (604) 226-7222
Fax: (604) 226-7446

3-6 AUGUST, 1995
Fifth International Ornithological Congress, to be held in Asunción, Paraguay.

Contact:
Nancy Lopez de Kochalka
Comite Organizador del CON
Museo Nacional de Historia
Natural del Paraguay
Surcusal 19, Campus, Central XI
Asunción, Paraguay
Tel: 595-21-505075

17-24 AUGUST 1995
Fifth International Congress on Systematic and Evolutionary Biology (ICSEB V), to be held in Budapest, Hungary.

Contact:
E. Szathmary
Dept. of Plant Taxonomy
and Ecology
Eötvös Univ.
Ludovika tér 2, H-1083
Budapest,
Hungary

23-26 AUGUST 1995
BioNET-INTERNATIONAL Global Workshop (BIGW), to be held at the National Museum and University of Wales, UK.

BioNET-INTERNATIONAL is a global network of people and institutions comprised of inter-linked sub-regional LOOPs in developing countries supported by a central Technical Secretariat (TECSEC) and a consortium of the world's major centres of biosystematic excellence. It is particularly concerned with Invertebrates and Microorganisms, and the objective is to provide developing countries with realistic self-reliance in biosystematics of these groups to support national programmes for sustainable agri-cultural development and wise use of biodiversity.

The Cardiff Workshop will be an interface for LOOPs, technical supporting organizations and donors, will address funding, operational strategies and priorities to achieve BioNET's objectives.

Contact:
Professor Tecwyn Jones
Director TECSEC at
CAB INTERNATIONAL
Bakeham Lane, Egham,
Surrey TW20 9TY, UK
Tel: (01784) 470111
Fax: (01784) 470909
e-mail: bionet@cabi.org

6-8 SEPTEMBER 1995
The Role of Marine Mammals in the Ecosystem, to be held in Dartmouth, Nova Scotia, hosted by the Scientific Council of the Northwest Atlantic Fisheries Organization (NAFO) and the International Council for the Exploration of the Seas (ICES).

Contact:
J. Sigurjonsson
Marine Research Institute
Skulgata 4
P.O. Box 1390
121-Reykjavik
Iceland
Tel: 354-1-20240
Fax: 354-1-62390
e-mail: johann@hafro.is

15-19 SEPTEMBER 1995

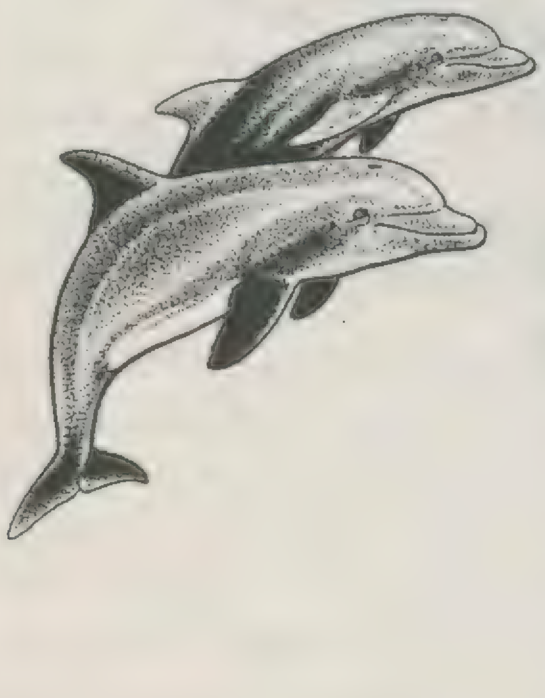
American Zoo and Aquarium Association (AZA/CAZPA) Annual Conference, to be held in Seattle, Washington, USA.

Contact:
Mike Waller,
Woodland Park Zoo
5500 Phinney Ave.
North Seattle, WA 98103
USA
Tel: (206) 233-2678

18-20 SEPTEMBER 1995

Third Thematic Conference, Remote Sensing for Marine and Coastal Environments, Technology and Applications, to be held in Seattle, Washington, USA.

Contact:
ERIM/Marine Environment
Conference
P.O. Box 134001
Ann Arbor, MI 48113-4001
USA
Tel: (313) 994-1200, Ext. 3234
Fax: (313) 994-5123
email: wallman@vaxb.erim.org



10-14 OCTOBER 1995

NOTICE OF MEETING AND FIELD TRIP

American Association of Stratigraphic Palynologists (AASP)

AASP 1995
Ottawa Canada
a CAPital experience

The Canadian Association of Palynologists (CAP) will host the 28th Annual Meeting of the American Association of Stratigraphic Palynologists from 10-14 October 1995 at Ottawa, Ontario. The four day venue will be held at the beautiful and historic Chateau Laurier Hotel with selected functions hosted and held at the Canadian Museum of Nature.

The programme will comprise several special sessions including a **Quaternary Palynology in Canada** symposium organized by Dr. Pierre Richard of the University of Montreal, Montreal, Quebec (Fax 514-343-8008 or E-mail richard@ere.umontreal.ca); **Dinoflagellates and Acritarchs of Mesozoic-Cenozoic Oceans and Marginal Seas** convened by Dr. Geoffrey Norris and Dr. Martin Head of the University of Toronto (Fax 416-978-3938 or E-mail norris@mica.geology.utoronto.ca); and a third session of **selected** papers from the AASP Foundation volumes, *Palynology: principles and applications*, convened by Dr. Graham Williams and Dr. Rob Fensome of the Geological Survey of Canada, Bedford Institute of Oceanography, Dartmouth, Nova Scotia.

A field trip to Eardley, Québec (Quaternary nodule site) and surroundings is scheduled for Saturday, October 14, and will be led by Dr. Richard Harington, Paleontologist with the Canadian Museum of Nature.

Individuals interested in registering are invited to contact:
Ms. Susan A. Jarzen,
AASP 28,
Canadian Museum of Nature,
P.O. Box 3443, Station "D",
Ottawa, Ontario,
Canada K1P 6P4.
FAX 613-954-4724
E-mail: sjarzen@mus-nature.ca.

The Canadian Association of Palynologists is confident that the Ottawa meeting will provide professional stimulation in a beautiful and historic setting, truly *A CAPital Experience!*

Dr. David M. Jarzen, Co-convenor,
AASP 28
Canadian Museum of Nature

Third Thematic Conference
Remote Sensing for Marine and Coastal Environments
Technology and Applications
18–20 September 1995
Seattle, Washington, USA

You are invited to attend the Third Thematic Conference on Remote Sensing for Marine and Coastal Environments and to visit Seattle, the Emerald City. Experts from over 30 countries will present over 300 papers that address the following topics:

- Emergency Response
- Oil and Chemical Spills
- Natural Disasters
- Natural Resources Management
- Water Quality
- Fisheries Management
- Urban Coastal Environment
- Public Health
- New Sensors and Systems
- Oceanographic Applications
- Acoustical Oceanography
- Ocean Surface Current Measurements
- Coastal Environment: Modeling, Monitoring
- Surface Validation
- Sea Ice Mapping
- Mapping and Charting
- Data Fusion, Integration, and Interpretation
- Training and Education

Preregistration Deadline: 18 August 1995

For more information contact:
ERIM/Marine Environment Conference,
P.O. Box 134001, Ann Arbor, MI 48113-4001
Telephone: 313-994-1200, ext. 3234, Fax: 313-994-5123
Internet: wallman@vaxb.erim.org

Please provide complete mail/delivery address and facsimile number on all correspondence.

94-20593 R15

22-28 OCTOBER 1995

Third Latin American Ecology Congress, to be held in Mérida, Venezuela.

Contact:
Jaime E. Péfur
Secretario Ejecutivo
III Congresso Latinoamericano
de Ecologiá
Facultad de Ciencias
Universidad de Los Andes
Mérida,
Venezuela 5101
Tel: 58 74 40-13-05
Fax: 58 74 40-12-86
e-mail: clae@ula.ve

18-21 OCTOBER 1995

7th Canadian Coastal Conference, to be held in Halifax, Nova Scotia.

Contact:
S. Solomon
Atlantic Geoscience Centre
Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, Nova Scotia, B2Y 4A2
Tel: (902) 426-9459
Fax: (902) 426-4104
e-mail: solomon@agcrr.bio.ns.ca

30 OCTOBER-3 NOVEMBER 1995

Consultative Group on International Agricultural Research (CGIAR) International Centres' Week, to be held in Washington, DC.

Contact:
The Secretariat
CGIAR
1818 H Street NW
Washington, DC
USA 20433
Tel: (202) 473-8951
Fax: (202) 473-8110

6-17 NOVEMBER 1995

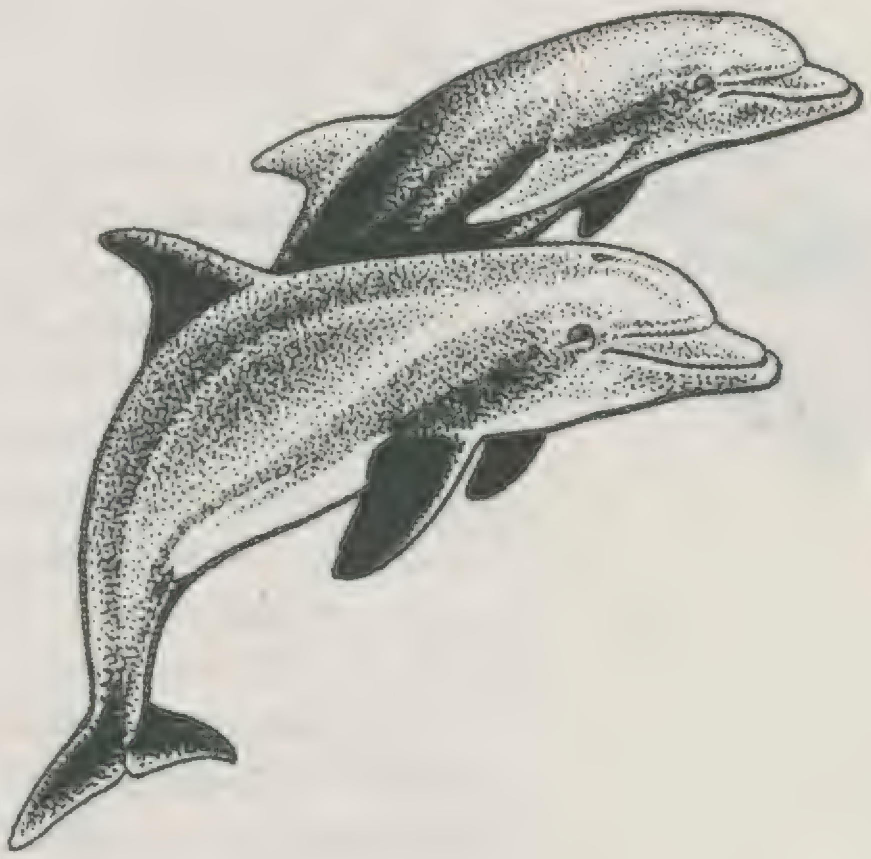
Conference of the Parties to the Convention on Biological Diversity, to be held in Indonesia.

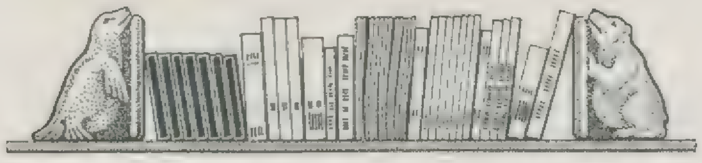
Contact:
Secretariat for the Convention
on Biological Diversity
Geneva Executive Centre
CP. 356, CH-1219
Châtelaine,
Switzerland
Tel: 41 22 979-9111
Fax: 41 22 797-2512
e-mail: adayao@unep.ch

16-17 NOVEMBER 1995

Environmental Enhancement Through Agriculture, to be held in Boston, Massachussetts.

Contact:
William Lockeretz
School of Nutrition
Tufts University
Medford, Massachussetts 02155,
USA
Telephone: (617) 627-3223
Fax: (617) 627-3887
e-mail: wlockeretz@infonet.tufts.edu





Book and Periodical Niche

The biophilia hypothesis.

Edited by Stephen R. Kellert and Edward O. Wilson. 1994. Island Press, Washington, D.C. 484 pp. Hardcover, ISBN 1-55963-148-1.

Why do so many country and suburban estates repeat the big-lawn scattered-trees pattern, no matter what the native plants and habitat may be? Why is the fear of snakes more prevalent than the fear of handguns, though the average North American is less likely to see the former than the latter? Why are animal names among the first words taught to infants? Why are the colour green and the sound of gently flowing water so soothing?

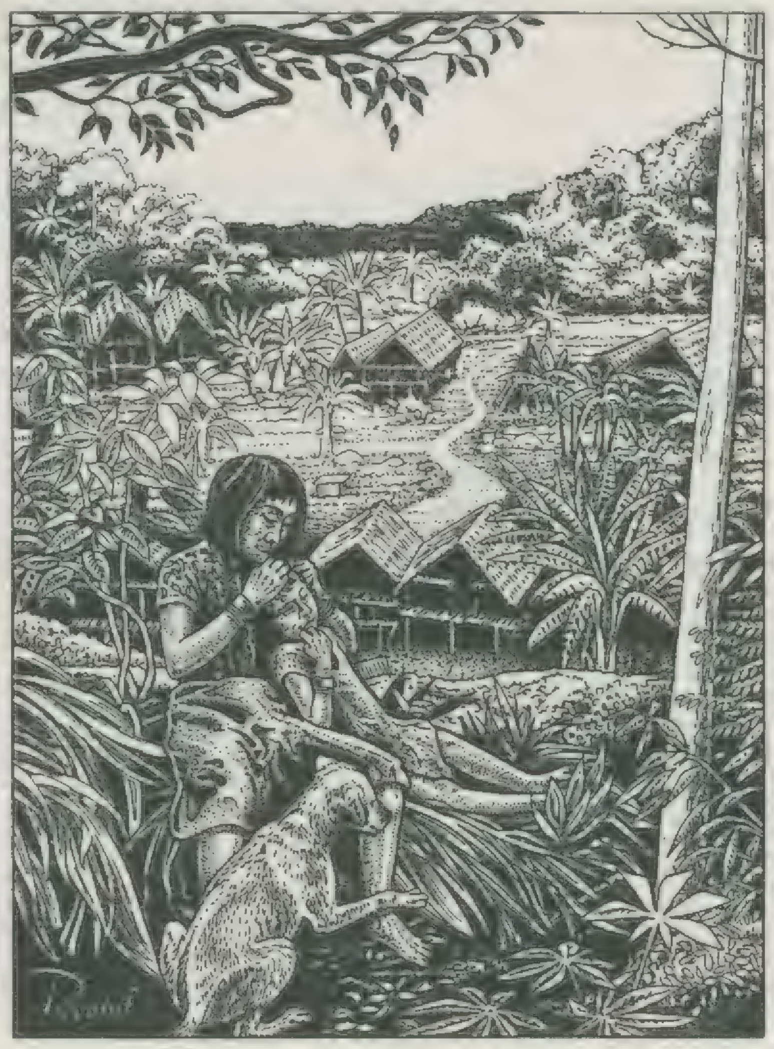
Edward O. Wilson, the famous Harvard biologist, thinks he knows.

In 1984, Wilson wrote a book called *Biophilia*. Ten years later, we have *The Biophilia Hypothesis*, co-edited with Yale professor of environmental studies, Stephen R. Kellert. *The Biophilia Hypothesis* is a collection of essays that respond to a renewed interest in the subject. What is biophilia, or literally *life love*? How is it manifest in humans? Is it innate or acquired, or both? How can we foster it for the benefit of biodiversity? How have other cultures dealt with nature, and can we learn from them? These questions, and many others, are raised and debated in this highly recommended volume.

At its most basic level, the biophilia hypothesis is about survival of the most observant. A discriminating eye will ascertain features of the environment, and classify them according to their effects (positive, negative, neutral). This information will be stored in memory for later retrieval. Pity the poor individual who doesn't notice that snakes can strike and bite, that tight spaces can be dangerous, or that green habitats tend to provide more water and food than deserts. Wilson and his followers believe, however, that it goes deeper than learning from one's mistakes, from trial and error. The environmental cues that increase the probability of human survival are also those more likely to make us happy, to put it simply.

And that is where the genetic part of biophilia comes in. Wilson contends that humans are innately predisposed to respond strongly to the environmental stimuli that are important for survival. This predisposition explains, in part, the wide-spread preference for certain landscapes (the open savannah being popular, since it affords a clear view of one's surroundings), the need for animals in our lives (even if that need becomes downgraded into merely keeping pets or visiting the zoo), and the prevalence of gardening as a leisure activity. We like these things because they're good for us—because their original forms were essential for survival.

Any talk of linking genes with something as complex as human behaviour—especially in its generalized, species-wide form—is bound to be fraught with controversy. This is nothing new to Wilson, author of the Pulitzer Prize-



Persons wishing to suggest materials for review or be considered as reviewers, please contact Patrick Colgan, Book Review Editor.

winning 1975 tome, *Sociobiology: The New Synthesis.* He provoked the wrath of scholar and layperson alike with his claims that traits, such as altruism and selfishness, were determined not by volition, but by our self-serving genes: the need to improve our Darwinian (inclusive) fitness. Will the same happen to this book?

To this reader, at least, the many fine arguments in *The Biophilia Hypothesis* are more than convincing. What clarified things for me was the all-important caveat that Wilson himself states in his own section, "Biophilia and the conservation ethic." Biophilia, he writes, "is not a single instinct but a complex of learning rules" that *predispose* us to behave certain ways. In other words, there is plenty of room for nurture to share influence with nature. If the proper stimuli are absent in the crucial stages of psychological development, then the response to the environment at large will be stunted. One may be left with, for example, only a great fear of snakes and spiders, a neutral reaction to all other creatures, and even a disdain for wilderness ("undeveloped land"). The implications of his hypothesis, therefore, go well beyond any petty squabbling over nature-nurture balances. Implicitly or explicitly, this is a call to action.

A cursory glance at the world today makes it clear that the vast majority of our species currently lives in conditions far removed from the natural. For 99% of human existence on Earth, we were gatherers and hunters, closely attuned to the environment. The more recent past has taken us further and further away from an alertness to the elements and kinship with other species. It is no surprise that some of the behaviour that saved our skins (and our genes) over millennia should persist to the present—and that a denial of these deeply rooted emotional needs should contribute to stress: physical and emotional, acute and chronic. Since the learning rules must be fostered in the proper context, the ways in which we raise children should be changed radically. The average child's love of animals is likely to be reinforced (and distorted) these days by Disney cartoons and plush toys. How much better for their future regard for biodiversity if environmental education (including contact with living systems and courses in ethics) were the norm.

These points are addressed in several essays in this book. In addition to the lead essays by the editors, "The loss of floral and faunal story: The extinction of experience" by Nabhan and St. Antoine and "Love or lose it: The coming biophilia revolution" by Orr stand out. The power animals hold as symbols in human culture is discussed by E. A. Lawrence, and Paul Shepard writes "On animal friends." Jared Diamond and Richard Nelson, in separate essays, search successfully for biophilia in aboriginal cultures, and M. Gadgil talks about life in India, and its plentiful biophilic elements. The aesthetic value of natural settings receives a thorough treatment in "Biophilia, biophobia, and natural landscapes" by Ulrich and in "Humans, habitats, and aesthetics" by Heerwagen and Orians.

Wrapping up the collection are an essay about genes and ethics by Holmes Rolston III and a conclusion by Michael Soulé. The only discordant note in this otherwise harmonious set of viewpoints is "God, Gaia, and biophilia" by Sagan and Margulis. Perhaps I have missed the point, but their explanation of everything from disappearing species to the value of such projects as Biosphere II (the experiment in creating a purportedly self-contained, self-sustaining ecosystem, which took place recently in Arizona) in terms of the Gaia Hypothesis was irritating and even a little chilling. "Conservation on an evolving planet is ultimately a lost cause," they say (p. 361), meaning that the equilibrium sought and achieved by Gaia for billions of years always has had casualties. Our biases show up when we mourn the disappearance of tigers, but not molluscs or microbes. Sagan and Margulis also ask, as have others, Is the planet really sick? And, can we ever hope to "heal" the environment? While this is certainly open to debate, they "would like to suggest that the decline in species diversity may be balanced by an increase in technological diversity—a trade-off that may ultimately enhance the longevity of the biosphere." (p. 362)

The Biophilia Hypothesis is mandatory reading for anyone dedicated to conserving biodiversity. Wilson is not afraid of expressing a deep passion for life, and neither should we.

Louise Fabiani, 572 Somerset W., No. 3, Ottawa, Ontario, Canada

Ecological microcosms.

By Robert J. Beyers and Howard T. Odum. 1993. Springer Advanced texts in Life Sciences, Springer-Verlag, New York. 557 pp, hardcover. ISBN 0-387-97980-8 (New York). US$59.00.

Ecological microcosms attempt to mimic naturally occurring ecosystems in the laboratory. The most commonly found and studied microsystems are, of course, aquaria and terraria. Beyers and Odum have attempted to collect and present knowledge of other laboratory systems that can be used to explain natural ecosystems and be manipulated to present "what if?" situations.

The book itself is divided into three divisions: 1. Principles, relationships and models; 2. The kinds of microcosms that have been commonly used in various studies—for the most part, aquatic systems, although Chapter 11 briefly discusses terraria and soil systems; 3. The use of microcosms by humans in the investigation of processes such as food and waste processing and their use in space exploration plus the techniques of ecological engineering. There are appendices that deal with the setting up and monitoring of simple systems for classroom teaching, suitable for grade and high schools. The authors, however, advocate them from this level up into university as far as graduate study programs. One appendix deals with the ill-fated Biosphere 2 program; and describes the laboratory Test Module upon which Biosphere 2 was based. This appendix was prepared by the designers of the "closed" ecological facility. There is an extensive and very useful bibliography on the subject of ecological mesocosms and microcosms.

The text is lavishly decorated with excellent line drawings and "energy system diagrams." The latter, in most cases, are extremely difficult to interpret because, as can be argued in natural systems, energy systems are extremely complicated and interlocking; it is very difficult to try to explain such systems through the use of drawings. Having said that, trying to sort out many of the energy systems presented is an exhausting and often fruitless task. If one is interested in a particular system, it may be worthwhile.

Another feature is an attempt to deal with published experiments on the use of various microcosms in the investigation of specific distribution and fate of chemicals and metals. Some descriptions are quite long, some are short. This may well reflect the knowledge of that particular subject and thus, lead into further research work on subjects of interest, but it does make for difficult reading. In fact, generally, the whole book is a difficult read. Nevertheless if one is contemplating the use of microsystems in the laboratory, with diligent searching, the book will supply information regarding published studies on the many systems used for their establishment. This is not a book to be read lightly; it is heavy going.

W.J.B. Ditchfield, 706-125 McLeod Street, Ottawa, Ontario K2P 2C7, Canada

Mammals in the palaearctic desert: Status and trends in the Sahara-Gobian region.

Edited by Jeffrey A. McNeely and Valeri M. Neronov. 1991. The Russian Academy of Sciences; the Russian Committee for the UNESCO Programme on Man and the Biosphere, Fersman Str. 13, 117312 Moscow, Russia. 298 pp. Paperback, US$20.00.

This book includes 20 papers, the substance of which were presented at the international symposium on "The conservation of rare and endangered mammal species by the Biosphere Reserves network in the Sahara-Gobian desert region." The first section considers general topics such as the continuing development of protected areas and conservation of rare species in the area; genetic history and diversity; and the impact of historical climatic changes. The second part provides some concrete data on the conservation of rare and endangered species in some specific countries of the Great desert belt. [Condensed from editor's foreword]

A naturalists' guide to the Arctic.

By E.C. Pielou. 1994. University of Chicago Press. paperback, US $19.95.

For those who will experience the Arctic firsthand and for armchair travellers who would rather just read about its splendours and surprises, here is the only guide to Arctic nature in all its forms. This book is a practical, portable guide to all of the Arctic's natural history: sky, atmosphere, terrain, ice, the sea, plants, birds, mammals, fish, and insects. It is packed with answers to naturalists' questions and with questions—some of them answered—that naturalists may not even have thought of. [Publisher]

National environment strategy for Jordan: A resource book of information and guidelines for action.

Compiled by John D. McEachern. 1991. Ministry of Municipal and Rural Affairs & the Environment, Department of Environment of Jordan and the World Conservation Union (IUCN), Gland, Switzerland. Translated from Arabic. 226 pp., 1 map. Paper, no ISBN, Jordan Department of Libraries, Documentation and National Archives deposit number 352/7/1991.

This National Environment Strategy contains over 400 specific recommendations and suggested actions in the field of environmental protection and conservation. Because it has been formulated by some 180 Jordanian specialists with substantial hands-on experience in the country, it is practical, realistic, comprehensive, integrated, and forward-looking. Readers wishing to delve into the particularities of a specific sector should turn to that chapter. This executive brief discusses several recommended strategic directions for action that apply to almost all natural resources planning and management in Jordan, and, if followed, would render the implementation of the sectoral recommendations easier and more efficient.

The strategic initiatives are:

- *Constructing a legal framework for environmental management.* A new framework is needed because existing laws and directives have been developed in a piecemeal manner.
- *Institutional strengthening.* Existing institutions must be strengthened including funding, staffing, training, equipment, educational outreach, and legal authority.
- *Expanded role for Jordan's protected areas.* Protected areas can play a greater role in environmental conservation through quantitative and qualitative means.
- *Bringing the environment to the people.* Public knowledge, awareness, support, and action will be the ultimate safeguard for the environment. The seeds sown today would catalyze a process on all fronts.
- *Stemming population growth.* Rapid population expansion, combined with extensive physical development of the land, add substantial new pressures to a delicate natural environmental balance. Drawing on its rich natural heritage and its Arab/Islamic values, Jordan must strike a more careful balance between its fast-growing population and the ability of its natural resource base to support this population at an adequate standard of living for all. A strategic initiative called "The National Health Programme for Birth Spacing" is now under consideration by the government and would involve governmental and non-governmental organizations, as well as international organizations.
- *Sectoral priorities.* Priority should be given to the issues of water and maintaining agriculturally productive land. [From the Executive Brief]

North American biotechnology directory.

1994. IEI Publishing, 1635 W. Alabama, Houston, TX 77006-4196. US$89.00.

A directory, covering Canada and the US, for the biotechnology/biosciences industry. Included are academia and research institutions; biotechnology companies; financial, legal, and consulting services; facilities and contractors; suppliers and manufacturers; government agencies and associations; and a buyer's guide to products. This directory is available in book, diskette, or mailing label format. [Publisher]

African diversity.

Three times yearly. "Seeds of Survival" Programme/ Ethiopia, with Unitarian Service Committe (USC)/ Canada, 56 Sparks Street, Ottawa, K1P 5B1. NGOs and individuals: CAN$10.00/annum, Institutions/ International Organizations: CAN$15.00/annum.

Funded by Partnership Africa Canada and the Canadian International Development Agency, *African Diversity* is intended to inform scientists, policy-makers, NGOs and other concerned members of Africa's agricultural community of recent and significant developments in the fields of plant genetic resources, bio-technologies, and biological diversity. [Publisher]

Different drummer.

Quarterly. Cascade Holistic Economic Consultants, 14417 S.E. Laurie, Oak Grove, Oregon, 97267. ISSN 1057-2724. Individuals and non-profit groups: US$21.95/annum; Government and commercial: US$27.50/annum.

This magazine is published by a non-profit organization dedicated to finding solutions to natural resource problems through research, education, and consulting. A recent issue included papers written by the participants in the first North American Conference on Social and Economic Incentives for the Conservation of Biodiversity.

Sourcebook on sustainable development.

1992. International Institute for Sustainable Development, 161 Portage Ave. E., 6th floor, Winnipeg, Manitoba R3B 0Y4. 134 pp. Paperback, ISBN 1-895536-04-9, CAN$20.00.

This book lists major sources of information on sustainable development. Included are listings of literature pertaining to economics and ecology; ethics and religion; credit and debt and structural adjustment. Also listed are institutions active in sustainable development, their addresses, telephone, and fax numbers. Audio-visual sources are identified, as are electronic conferences and databases, with details of content, coverage, and access. [Condensed from Publisher]

A Guide to the Convention on Biological Diversity.

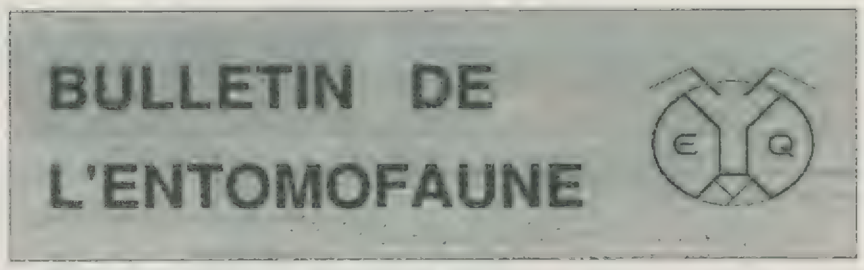
By Lyle Glowka, Françoise Burhenne-Guilmin, Hugh Synge, Jeffrey A. McNeely, and Lothar Gündling. Environmental Policy and Law Paper No. 30. 1994. The World Conservation Union (IUCN). 200 pp. Paperback, ISBN 2-8317-0222-4, £13.50 (plus shipping, 20% surface, 40% air)

The Convention on Biological Diversity is the first global agreement to address all aspects of biological diversity: genetic resources, species, and ecosystems. This guide aims to promote understanding of the Convention's text and its possible implications. It explains the Convention, highlights some of the scientific, technical, and legal issues upon which it is founded, and provides possible approaches or options. [Condensed from Publisher]

A law for the environment/Un droit pour l'environnement/Ein Recht für die Umwelt. Essays in honour of Wolfgang Burhenne.

Edited by Alexandre Kiss and Françoise Burhenne-Guilmin. 1994. The World Conservation Union (IUCN). 275pp. Paperback, ISBN 2-8317-0203-8, £15/US$22.50.

Honouring a lifetime of commitment to the development of environmental law, these essays by eminent contributors provide varying perspectives on environmental law ranging from its history and development to specific problems at national and international levels. Original texts in English, French, or German. [Condensed from Publisher]



BULLETIN DE
L'ENTOMOFAUNE

Bulletin de l'Entomofaune.

Newsletter. Entomofaune de Quebec, Laboratoire de biosystématique, Université de Québec à Chicoutimi, 555 boul de l'Université, Chicoutimi, Québec, G7H 2B1. Subscriptions CAN $5.00.

Founded in 1987, this newsletter is distributed at least once a year. It is the official organ of the corporation "Entomofauna of Quebec" and serves to spread general and technical information on all aspects of the development of the Entomofauna. About 300 copies are distributed, and subscriptions are available from the Secretariat at the above address.

This review is based on Issues 11-13 (June & December, 1992, and June 1993) of the newsletter.

Each issue contains a mixture of technical and more general information of interest to both amateurs and professionals. The articles, organized under interesting headings such as "The Tool Box" and "The good words of the entomologist," are written in a lively style while remaining scientifically accurate, educational, and informative. The main goal of the newsletter is to promote the study and inventory of the Quebec insect fauna. However, various articles of more general interest are included, such as the origin and derivation of scientific names, preparation and conservation of insect specimens for collections, and building an insect collection. An editorial discusses various aspects of current interest, eg. BADIQ (see below), biodiversity management, etc. As well, notes on meetings, news of the corporation, and available checklists on the Quebec fauna (for sale), are given: these items serve mainly to inform the Quebec community of entomologists, which includes perhaps the highest proportion of amateur entomologists of any state or province in North America.

Issue 11 deals principally with a database for the Quebec fauna. In 1987 a group of professional entomologists in Quebec launched a relational database program for the invertebrates of Quebec. This database, termed BADIQ (Base de données sur les invertébrés du Quebec), became operational in 1992 and runs on a **Vax4000 VLC**. It cost about half a million dollars to develop, including grants and institutional support. A simplified version that runs on both MacIntosh and IBM-clone microcomputers has been developed, and will be available in July 1995. An operations manual and the program will be sold for a reasonable price to all interested. Although designed for insects, the program can be used for any group of organisms as it is able to manage samples and associated data whether descriptive, taxonomic, ecological, or bibliographic.

The program presently comprises more than 330 fields that open the door to multi-relational research. It supports cartography, collection management, taxonomic synonymy, habitat description, etc., and is easily adaptable and enlargeable due to a system of hierarchical descriptors. A thesaurus includes more than 3,500 terms and can be modified or expanded as desired. Once completed, the database will permit the development of a databank of standardized primary data on species. Special care will be given to facilitate and automate as much as possible the scientific validation of information during data capture. Categories of data in BADIQ are grouped under Sampling, Environment, Individuals/Specimens, Identification, Behaviour, Toponomic information, Taxon information, Source information (eg. card files on people, bibliographies, etc.). The group of people who developed the database program invite all who are interested in databasing to examine BADIQ and eventually contribute to it.

Issues 12 and 13 give further information on BADIQ as well as articles of general interest to entomologists. Some of the information summarized or discussed deals not only with Quebec but also, other French-speaking countries. In this respect, the newsletter acts as a sort of conduit of information from various principally French-speaking areas of the world.

In summary, from an examination of the three issues available to me, I believe that the entomologists of Quebec have a high quality newsletter that must surely serve its purpose well—to promote study of the province's fauna in a scientific manner and to provide an interesting and informative newsletter that is sure to attract more people to the science of entomology. It is a pity that each issue could not be translated entirely into English. Many good ideas are presented, especially on databasing, that would be worth bringing to the attention of non-francophones.

John Huber, Canadian Forestry Service, c/o BRD/CLBRR, Ottawa, Canada.

Environmental review.

Bi-weekly digest. Environmental Information Services, P.O. Box 86278, North Vancouver, BC, V7L 4J8. CAN $179.00 + GST/annum (mail); CAN $259.00 +GST/annum (fax).

Environmental Review is an independent, Canadian, bi-weekly digest that provides an up-to-date, clear and objective summary of environmental news and legislation updates, trends, public opinion monitors, new technologies, developments in business and government, resources, and regional and national events. It is available for a 14-week trial basis. [Publisher]

Quebec law and the environment

The following publications will be very useful to those seeking to know more about Quebec laws on the environment.

Environnement et droit is published by the **Centre de recherche et d'information en droit de l'environnement** (CRIDE), associated with the **Centre québécois du droit de l'ennvironnement** (CQDE). Both are corporations without share capital whose mission is to promote the right to a clean environment and access to justice for Québecois and the ecological groups of Quebec. The courts, the National Assembly, the media, and the groups that have benefited from the services offered by these centres have recognized the importance of the Centres, their professionalism, and their capacity to represent the public interest in matters of environmental law.

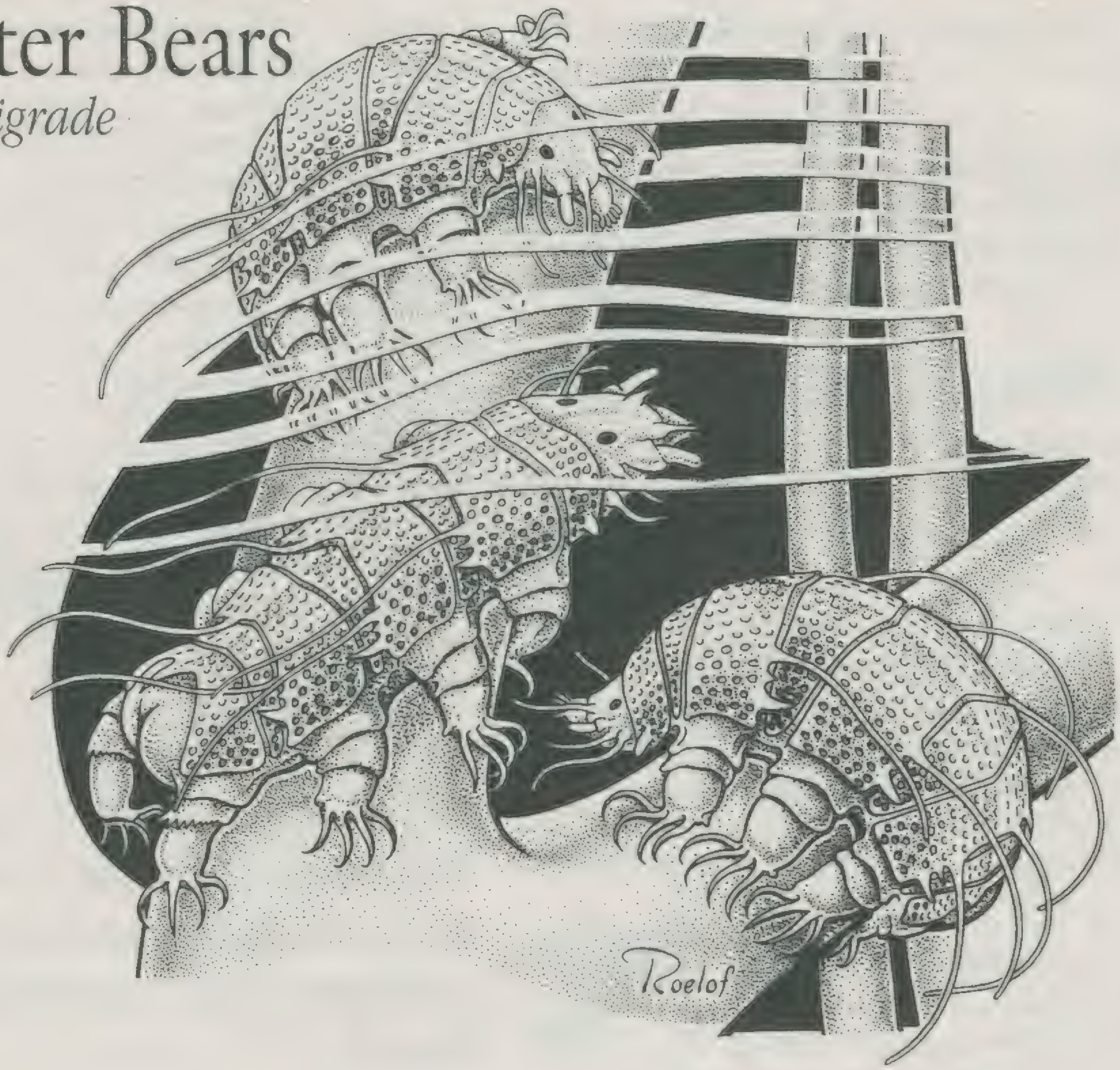
Pierre B. Meunier and André Durocher of the law firm Martineau, Walker are the authors of the *Bulletin du Droit de l'environnement* (Yvon Blais, publisher). Mr. Meunier, president of the environmental law group of that law firm, has also published *Droit québécois de l'environnement*. The three loose-leaf binders of this important publication are updated three times a year. He has furthermore published *Droit de l'environnement*, a compendium of the most important statutes and legislative enactments currently applicable and affecting all Québecois and Quebec organizations.

Lastly, *L'environnement au Québec* is a two-volume loose-leaf book published by C.C.H, including a quarterly newsletter and update. I hope that this information, without being very detailed, will be useful to all readers.

Pierre Giguère, lawyer, former trainee at CQDE, Montréal

Water Bears

Tardigrade



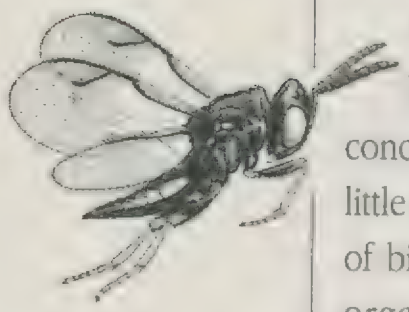
The tardigrades (*Echiniscus* species) pictured here are magnified about 120 times. Special thanks to R. Deedee Kathman, Aquatic Resources Center, Franklin, Tennessee for her help.

Species in the phylum Tardigrada are referred to as water bears. These small (50 μm to 1.2 mm) animals are characterised by a distinct head and four body segments, each with a pair of legs tipped by claws. The Latin name Tardigrada means "slow stepper" and comes from the rounded body, the head-down posture, and the deliberate "pawing" locomotion. The taxonomic affinity of tardigrades is still debated. Most authorities have placed them as a sister group of Arthropoda; although say they are more closely related to the Aschelminthes group (nematodes, gastrotichs, kinorhynchs) or the Onchyphora (velvet worms). Most of the 700 described species (in about 65 genera) are semiaquatic and occur mainly in thin films of water on terrestrial mosses and lichens. The few truly aquatic freshwater species are found in sediment and algae. Marine species occur as part of the meiofauna in sand. (Meiofauna are animals between 1 - .04 mm in length.) Tardigrades are mainly plant feeders. Cellulose walls of moss leaflet cells and algal filaments are pierced with stylets and fluid contents sucked out. Some species feed on nematodes and rotifers.

This group is remarkable in its range. Tardigrades are found from the tropics to the Arctic and the Antarctic; they live as deep as 100 m on lake bottoms, 4,700 m in the oceanic abyssal zone, and on mountain tops as high as 6,600 m. One feature that contributes to this ubiquitous distribution is the ability of terrestrial tardigrades to avoid or resist some adverse environmental conditions by forming dry, barrel-shaped resting stages called tuns or by forming thick-walled cysts. In these states, they resist temperatures ranging from 151°C to -270°C (nearly absolute zero). The lethal dose of x-radiation for tardigrades is 570,000 roentgens. For humans, it is 500 roentgens! If the principle of such resistance were discovered, it would have substantial impact on radiation safety and future space travel.

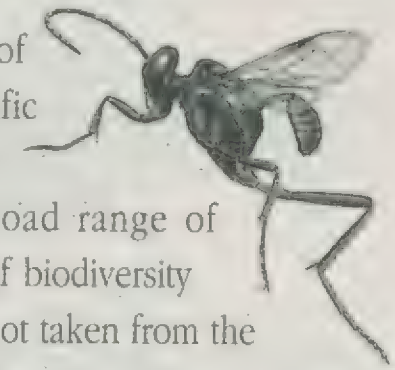
Hymenoptera and biodiversity

Edited by John La Salle and Ian D. Gauld. 1993. C.A.B. International, Wallingford, Oxon, UK, 320 pp. ISBN 0-85198-830-x. £49.50.



Documenting, understanding, and conserving biodiversity is one of today's primary societal concerns. Paradoxically, despite this claim, we know very little about much of biodiversity, largely because the bulk of biodiversity is comprised of small, rather non-descript organisms. These sorts of organisms have not commanded the same attention in the past as have mammals, birds, fish, and the like. For example, it is estimated that we only know about one-half of the insect fauna of Canada (actually a relatively well-known insect fauna by world standards).

Most species of organisms are insects in the orders Coleoptera (beetles), Lepidoptera (butterflies and moths), Diptera (flies), and Hymenoptera (bees, wasps and ants). These four "megadiverse" groups account for well over one-half of the presently known world biodiversity. Thus a book, such as this one, dealing with the extent and nature of diversity within any one of these orders has a lot to say about world biodiversity in general.



The book is a compilation of contributions, varied in specific focus and content, but accurately reflecting the broad range of subject matter that the study of biodiversity entails. The contributions are not taken from the proceedings of a symposium but rather appear to be an assemblage of invited papers. Collectively, these address not only the question of what portion of biodiversity is accounted for by Hymenoptera, but how the species of Hymenoptera affect diversity in other organisms. In this sense, it is not so much a book about Hymenoptera, but about biological principles and processes that underlie the genesis and maintenance of biodiversity.

There are 15 chapters in the book. Of special note are chapters on Hymenoptera and their impact on diversity in other organisms (LaSalle and Gauld); threats to Hymenopteran diversity in Central America (Vinson *et al.*) and South Africa (Gess and Gess); Hymenoptera and pollination (Neff and Simpson); biodiversity of parasitic Hymenoptera and their use in biological control (LaSalle); diversity of parasitic Hymenoptera (Hawkins); and, geographic patterns in Hymenopteran biodiversity (Gaston). Three more general chapters, not dealing specifically with Hymenoptera, conclude the book. These focus on taxonomic work in tropical countries (Janzen); measuring biodiversity for use in establishing conservation priorities (Williams *et al.*); and, a case study of Costa Rica and how it is tackling the study of its biodiversity (Gamez and Gauld). I found these latter three chapters, particularly that on establishing conservation priorities, to be the most interesting. However, even as a non-hymenopterist, I found nearly all chapters to touch on topics that I feel will be of general interest to most biologists.

All in all, the book is a quality production. It deals with an important contemporary subject matter in a very readable manner. Don't be put off by the title and assume this book is just about bees, wasps, and ants.

Robert S. Anderson, Research Scientist, Canadian Museum of Nature

Biodiversity and the Grande-Baleine hydroelectric development. Great Whale environmental assessment: Background Paper No. 11.

By Noel Alfonso and Don E. McAllister. 1994. Great Whale Public Review Support Office, 1155, rue Sherbrooke Ouest, bureau 1603, Montréal, Québec, H3A 2N3. 75 pp, softcover, ISBN 1-895931-07-X.

This compact volume (47 pages of text, with references, a glossary, and a 20-page appendix) examines the concept of biodiversity and implications that environmental change may have on it. There is particular reference and focus on changes that might be caused by the proposed Great Whale hydroelectric project in Quebec, Canada, which has now been postponed indefinitely. It emphasizes the economic benefits of a high level of biodiversity, and the damage that can result from its degradation.

The authors demonstrate that local ecological interventions, such as damming the river or the construction of an access road or a transmission line, can cause serious loss of biodiversity over very large distances. Such effects are difficult to predict.

The study outlines available data on the existing ecology of the large area in which effects of the project would be expected. It reviews data on three broadly representative categories of animal species (mammals, freshwater molluscs, and marine fishes) found in that area. It notes that in a number of categories such data are not available with the detail and reliability needed to forecast confidently the environmental consequences of ecological interventions. Hence, the impact the project would be likely to have on the biodiversity of the study area is hard to assess.

The book provides a useful overview of biodiversity as a science. However, its value as a basis for environmental policy formulation with regard to the Great Whale project, as the authors recognize, is limited by the inadequacy of the available data. In light of the recent deferral of the project, or perhaps its cancellation, this may not be important.

The material presented would be more readily accessible to the lay reader if the glossary were considerably expanded.

David Kirkwood, 260 Metcalfe St., Apt 1B, Ottawa, Ontario, K2P 1R6, Canada

Biological diversity conservation and the law. Legal mechanisms for conserving species and ecosystems.

By Cyrille de Klemm and Clare Shine. 1993. The World Conservation Union (IUCN) in collaboration with WRI and UNEP. 292pp. Paperback, ISBN 2-8317-0192-9, £15/US$22.50.

This volume covers the full spectrum of legal mechanisms available for conserving biodiversity. Part I discusses state powers to conserve wild species and habitats, procedures to identify vulnerable species, mechanisms to taking control, and trade and enforcement. Part II covers area-based conservation at various levels, trans-frontier areas, and those beyond national jurisdiction. It discusses protective measures such as public ownership, voluntary agreements, and regulatory measures, and other conservation tools and programs. [Condensed from Publisher]

Report of the global biodiversity forum.

IUCN Headquarters Gland, Switzerland, 7-9 October 1993. 1994. The World Conservation Union (IUCN). 115pp. Paperback, ISBN 2-8317-0219-4, £5/US$7.50.

This trilingual report completes *Widening Perspectives on Biodiversity*. It seeks to reflect the wide diversity of views of the 130 participants from 50 countries representing the spectrum of professional interests and backgrounds who contribute to the discussion. [Publisher]

Women in conservation. Tools for analysis and a framework for action.

By Dounia Loudiyi and Alison Meares. 1993. The World Conservation Union (IUCN). 164pp. Paperback, ISBN 2-8317-0196-1, £13.50/US$20.00.

This annotated bibliography provides recent examples, case studies, data, and theory, which illustrate the roles and responsibilities of rural women in developing countries in the use and management of natural resources. It also describes the accompanying social, political, and cultural dimensions that influence sustainable use of natural resources by women. [Publisher]

The green trees beyond: A memoir.

By R.D. Lawrence. 1994. Stoddart Publishing Co. Ltd., 34 Lesmill Road, Don Mills, Ontario, M3B 2T6. 320 pp., 8 pp. b/w photos. Cloth, ISBN 0-7737-27906, CAN $24.95.

One of Canada's most prolific nature writers, R.D. Lawrence has made a career of describing wild places and their inhabitants. *The Green Trees Beyond* is a candid memoir that documents Lawrence's early interest in nature and follows his life through the upheavals of the Spanish Civil War and World War II to Cambridge and then to Canada. It describes what drew the Spanish-born Lawrence to this country and shows why he's widely known as an influential advocate of wildlife conservation. [Condensed from a review by Alec Ross of Kingston]

Aboriginal fishing rights.

The British Columbia Aboriginal Fisheries Commission and *The Moment* Project of The Jesuit Centre for Social Justice. 1994. The Moment, 947 Queen St. East, Toronto, Ontario, M4M 1J9.

"Aboriginal Fishing Rights" is a special edition of *The Moment*, a magazine dealing with aboriginal issues, written by people of the First Nations and published three times yearly. This edition speaks about the struggle to exercise Aboriginal fishing rights. It deals with issues of access, conservation, and commerce, and suggests actions readers might take to express solidarity with First Nations. "Aboriginal Fishing Rights" is available from the above address for $3.50 for individuals, and $5.00 for institutions, with discounts available for orders of 10 or more. Subscriptions to *The Moment* are available. Individuals: $10.00/1 year, $18.00/2 years; Institutions $14.50/1 year, $25.00/2 years. (All prices are in Canadian dollars.) [Publisher]

Guidelines for institutional policies and planning in natural history collections.

1994. Association of Systematics Collections (ASC), 730 11th Street NW, 2nd floor, Washington, DC 20001-4521. 124 pp. ISBN 0-942924-17-7, US $22.00.

This book reviews current practice and suggests important elements to include in policy documents for institutions that house biological, anthropological, and geological collections. Topics range from accessions to orphaned collections. Emphasis is given to emerging policy issues within the natural history community, such as documentation, archives, ethics, health and safety, and hazardous wastes. In addition, there are guidelines for writing mission statements and developing a strategic plan. Each chapter includes a bibliography and references to related articles published by ASC. [Publisher]

People, development and environment. Complex interlinkages in Bangladesh.

Proceedings of a national symposium held in Dhaka, Bangladesh, 3-4 November, 1992. 1993. The World Conservation Union (IUCN). 170pp. Paperback, ISBN 2-8317-0192-9, £12.50/US$18.75.

The eight technical papers emphasize what is needed as the development process unfolds: workable models for sustainable resource use; the participation of people throughout the community in discussions about their own future; legal reforms concerning the environment and human rights; and monitoring and the continuing adjustment of policies and actions. [Condensed from Publisher]

Hiking guide to the big trees of southwestern British Columbia

By Randy Stoltmann. 1987. Western Canada Wilderness Committee. Vancouver, B.C., Canada. 144 pp., black and white plates and hand-drawn maps. Paperback, ISBN 0-9692230-2-1. $9.95.

Have you ever had the urge to hug a tree? You would have to have been hanging from your arms in a dingy torture chamber since childhood or else related to Elastoman to get your arms around these hefty blocks of wood. As you walk beneath the old growth forests in British Columbia (B.C.), you feel as if you're the size of your hiking boot. You arch your back and crane your neck to see the trees towering overhead, seeming to reach forever into the sky. Get a few of your friends together, go for a hike, and stretch hand to hand around the tree's base and hug it that way.

Even by reading this publication, paper consumption continues and pulp mills respond by pressuring to cut down more of the remaining old-growth forest still left in B.C. The Western Canada Wilderness Committee has published this guide to allow people to appreciate the size and the spirit of the old trees and to generate revenue to continue research on old large trees.

Randy Stoltmann's guide to some of the big trees in this area walks the reader and the hiker through well-mapped circuits of tree-spotting. The book features 29 hikes of varying accessibility and difficulty that feature large trees of various species. Both the afternoon stroller and the compass hiker can benefit from the specific directions and the informed descriptions of these trees and their histories. A number of the hikes are easily accessible by car from Vancouver and Victoria and wind their ways through parks, such as Stanley Park, Lighthouse Park, or John Dean Park. Other hikes are in more remote areas, perhaps requiring transit on logging roads or even off-trail hiking. This practical, informative, interesting book is unique because it gives hikers the key to opening up the old coastal forests to their appreciation, spotlighting specific trees along the way.

Rhiannon Johnson, Ocean Voice International, Vancouver, B.C.

The rising seas

By Martin Ince. 1990. Earthscan Publications Ltd. London, England. 152 pp. Paperback, ISBN 1-85383-077-1. £5.95(UK).

The Rising Seas explores the impacts a higher sea level might have on the coastlines of the world and the world's ability to cope. As a result of global warming, ocean waters could expand, glaciers and snowpacks could shrink, and the Antarctic icefields could melt or collapse, causing a rise of sea level up to one metre worldwide. A rise in sea level would sneak up on coasts and identify itself through more frequent disasters or problems such as extreme flooding, increased salt contamination of fresh water, accelerated land erosion, stressed corals, and other symptoms.

Martin Ince's book describes these disasters resulting from higher waters and discusses technological solutions already used in developed countries, such as England and the Netherlands. He admits, however, that these solutions are beyond the scope of poorer countries. Because sea level rise is a possible problem of the future, it is strange that the author does not discuss the technology that is still being developed or existing technology that is not applied on a large scale. The content lacks in solid solutions for poorer countries, although that may be because few solutions are affordable. Ironically, poor countries would be more impacted by a rising sea level than the rich. Ince gives the standard advice of international communication, planning and co-operation toward finding solutions of protection against the ocean, and global abatement of carbon emissions. After detailing numerous encroaching disasters, however probable, he offers few solid solutions.

Ince, a science journalist, attempts to be unbiased and informative in his style, but sometimes he swamps the reader in information and loses his focus on the issue by berating the facts. Despite this, and despite not offering hope in the form of solid solutions, he covers the issue comprehensively and raises some interesting points. He reminds us of the possible moral obligation of the global warmers to bear or share the costs of conservation with the South. He also reminds us that global warming is still theory, although more evidence is being gathered in support of this theory, and that predicting impacts are difficult, however well thought-out. The book will extensively inform someone with little or no knowledge and will reveal connections, motivations, and effects not thought of previously to those educated on the issue.

Rhiannon Johnson, Ocean Voice International, Vancouver, B.C.

The capacity for wonder: Preserving national parks

By William Lowrey. 1994. The Brookings Institution. Tel. (202) 797-6105. US$28.95.

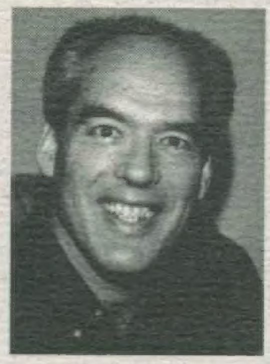
This is the first systematic comparison of U.S. and Canadian national parks. It details problems and successes with the national parks services in both countries. Amongst other conclusions is that the Canadian national parks are healthier than those in the U.S.A.

GreenWorld's almanac & directory of environmental organizations.

1994. GreenWorld Environmental Publications Co., 253 A 26th Street, Suite 306, Santa Monica, CA 90402. 342 pp., softcover, ISBN-0-9640403-1-X. US $29.95 + shipping and handling $3.00 (US), $5.00 (foreign)

GreenWorld's Almanac and Directory provides a listing of over 700 major environmental organizations based in Canada and the United States, classified according to their main area of concern. It is organized into four sections: global environmental challenges; the earth and its natural resources; environmental impacts of human activities; and human responses to environmental challenges. Each of the twenty-one chapters is introduced by a brief article dealing with a particular environmental issue, including charts to highlight key trends. A list of organizations focusing on that issue then follows, including information about their goals, history, membership, funding and usage, programs and publications. There are also alphabetical and geographical indices of all organizations included in the publication.

Preserving our natural diversity



This is the first of a series of articles in which you will find my personal opinions, all of which have evolved from a wide range of personal experiences in nature, science, treaty negotiation, management of museums, and policy-making. In a recent address to the Standing Committee on the Environment and Sustainable Development, for instance, I made a series of simple recommendations to ensure the safe-keeping of our natural diversity. Perhaps you would find them useful as well.

We need to adopt a view of "wildlife" as equivalent to all life and its variations. Wildlife can only be managed using ecosystems, not single species. Predictive models of entire systems are needed. The Canadian Museum of Nature has developed the National Institute for Systematics and Biodiversity to develop a predictive model of the lower threshold limits of biodiversity for Canada and possibly for the world. The museum already has a beginning biodiversity database. We also know that by instituting a zoned land use policy (1/3 wilderness, 1/3 agricultural and suburban, and 1/3 intensive urban) about 75 to 80% of the current biodiversity will be safeguarded . Canada can use rare and endangered species as critical indicators of success or failure of the strategy to save biodiversity.

We need to develop an inventory of habitats and species. This can be done by people with specialized but minimal training (parataxonomists). This would make possible data management, improvement and rehabilitation of inappropriately disturbed areas, definition of keystone habitats (such as wetlands), maintenance of agricultural controls, control of outbreaks of pests, parasites, diseases, and control of exotic or genetically-engineered species introductions.

We should immediately embark on a public education and awareness campaign to support concepts of use for today while preserving the natural world's support system for future generations. This will mitigate the polemic and polar attitudes of people to the exploitation or captive use of wildlife by ensuring credible information is available on what effect these practices really have. If people understand the issues, they can separate the reasonable from the ridiculous.

Finally, it is important to encourage an increasing knowledge, interest, respect, and appreciation for the natural world so as to improve our collective attitudes and behaviour toward the natural world. This can only be done if people are also encouraged to be personally in touch with nature. The Canadian Museum of Nature has a program specifically entitled "In Touch With Nature." The wonderful high-tech imagery of pristine areas depicted on television, or in books and magazines, often gives a falsely comforting view of what the wildlife situation really is - these amazing depictions keep us *out* of touch with nature. It is currently estimated that our urban populations spend less than 4% of their time out of doors. No one values what they do not understand, and this is far too little time to understand nature.

Alan R. Emery, Ph.D.
President

A few words about the Canadian Museum of Nature

The origins of the Canadian Museum of Nature (CMN) were formed within the Geological Survey of Canada in 1842. Over 150 years later, the CMN has some 8 million specimens in its collection, which still represents only half the known species in this country, and an active team of scientists, collection managers, education specialists, and business experts.

The CMN's mandate is to increase knowledge and understanding of, appreciation and respect for, and interest in the natural world. This role has never been more crucial, as the demand for environmental harmony between the world's burgeoning human population and nature reaches a critical point. For more information about the Museum's activities, please contact Karen Hahn, Corporate Communications at 613-990-6273.

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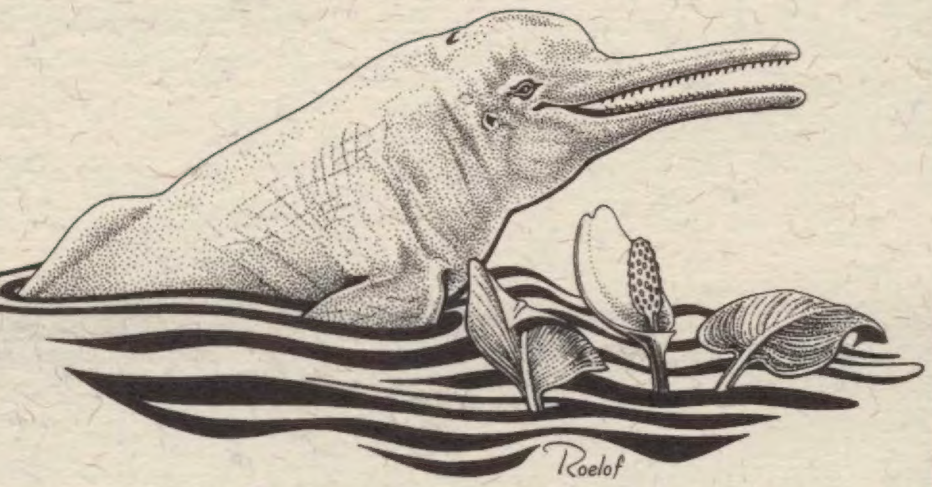

Amazon River Dolphin *(Inia geoffrensis)*
For more details on this freshwater mammal, see page 10.

One star slowly moving across the great window hinting of the time and the vast spaces through which we hurtle.

The last notebooks of Loren Eiseley, 1987

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